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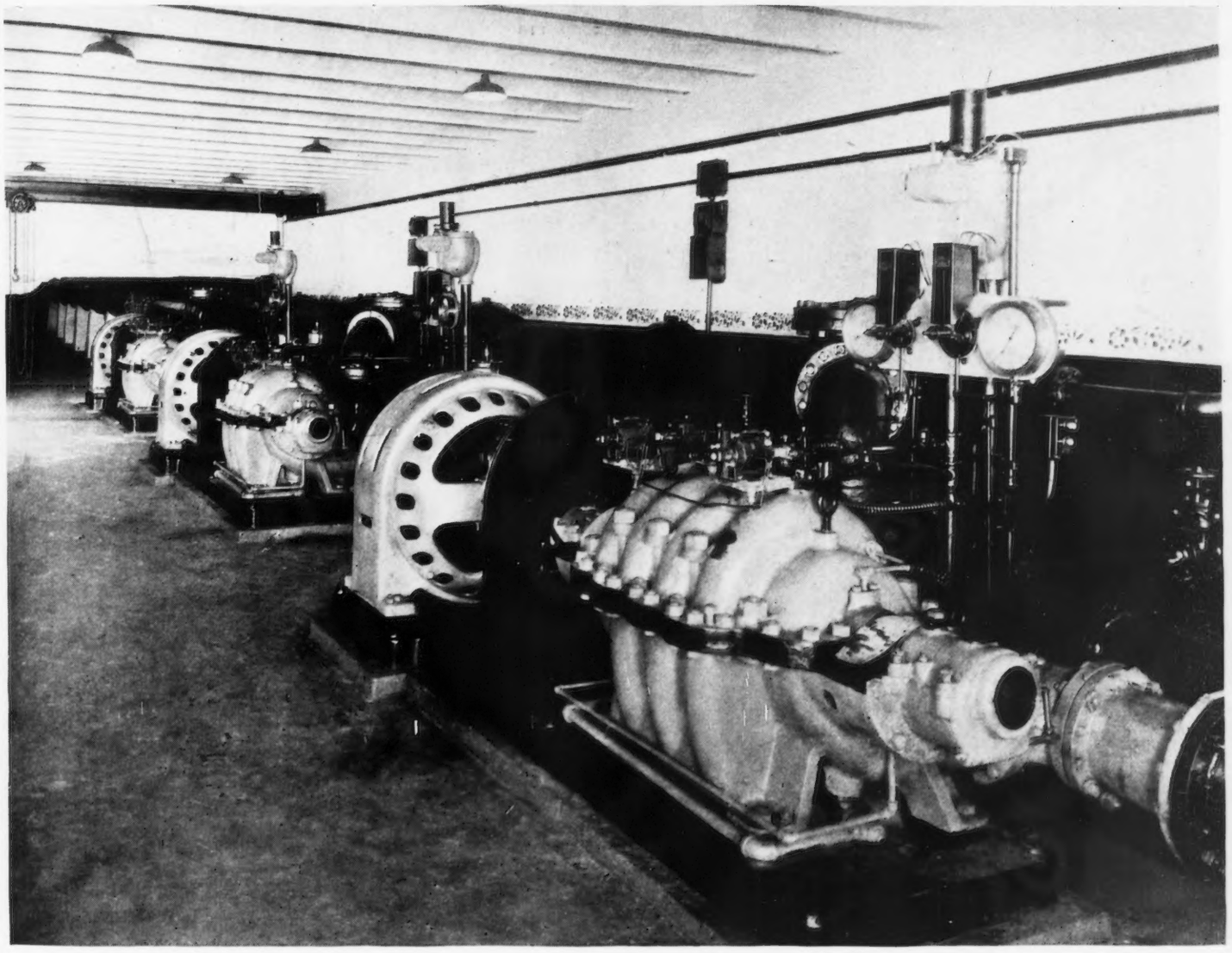

An Automatically Controlled Mine Pumping Plant

Controlling Centrifugal Pumps Automatically, by A. H. Hubbell

Mining Research—A Problem in Oil-Shale Extraction, by T. M. Bains

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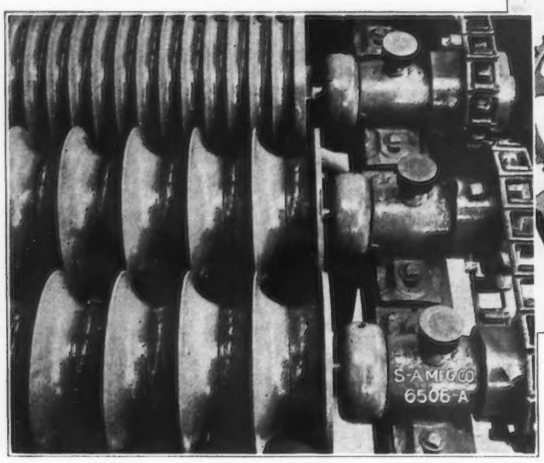

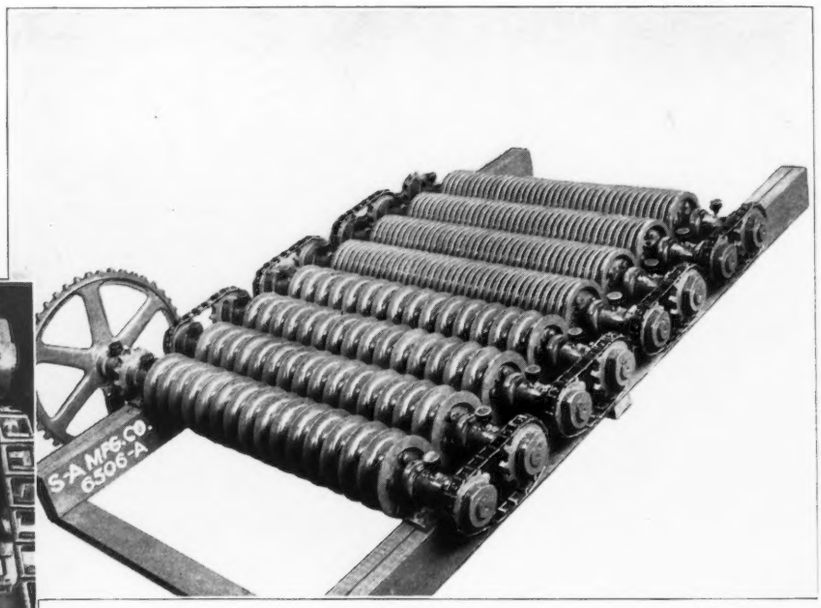

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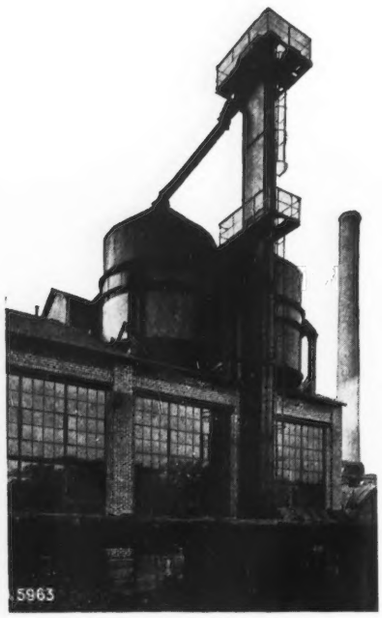

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Volume 121 New York, June 19, 1926 *Number* 25

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ENGINEERING AND
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JOSIAH EDWARD SPURR, Editor

Volume 121 New York, June 19, 1926 *Number* 25

Buy for the Future

THE DEMAND for the various metals and minerals which are employed in industry is not a fixed but a highly variable one. In general the consumption of the products of the mines by the world increases steadily, and is without any visible—almost, one might say, possible—limit. Population increases at an unprecedented rate, in spite of sporadic birth control; and each individual, with the improvement of the industrial organization, consumes more and more of the mines' products. Moreover, the demand for each metal, and each mineral that is used as such, changes with the development of new industrial processes. The price of platinum soared with the great expansion of the chemical industry, whereby Wealth and Luxury, perceiving that platinum was more expensive than gold, even if not so distinctive or beautiful, chose it in preference for jewelry and helped to boost the price. There is a class of buyers who demand that a thing be expensive. Therefore the future large production of platinum from South Africa will be absorbed by an increased demand. Molybdenum was seeking industrial uses and a price quotation long before it found its place. Tantalum, a metal long without a market, has gradually found increasing industrial uses, and a latent demand exists for new supplies. Selenium, another metal for which the world had no particular use, is also being increasingly utilized, the latest demand being for use in an improved process of vulcanizing rubber.

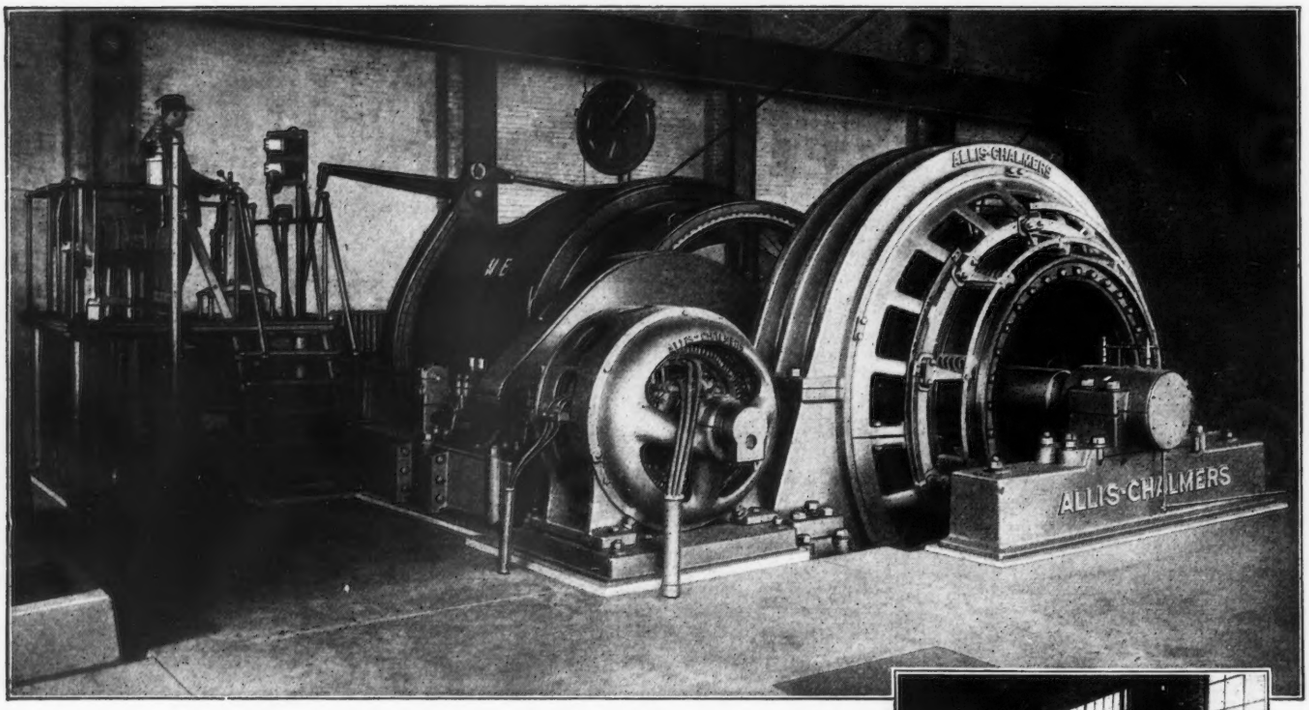
Even among the commoner metals, their status is constantly changing. It is not so far back that zinc, in our Western states, was not an asset, even though in ore of fairly high grade; miners looked upon it in the light of a liability.

Unmistakably, this process of increased demand for metals and minerals will go steadily on. Whoever has a sizable deposit of any useful—or even, in some cases, apparently useless—metal or mineral, which will not quite pay for exploitation at present should bide his time. Ten chances to one, it is money in the bank, and the safest bank in the world. And the likelihood is that he will not have to wait longer than the average real-estate investor has to wait before he can realize a profit by a rise in land values. This truth applies to all utilizable earth products, in varying degrees. A copper mine is not so valuable now as it will be ten or twenty years hence. Lead and zinc mines should similarly increase in value—and the same is true pretty much down the line. Even gold mines should be more valuable in the future, if, as seems probable, the purchasing power of the dollar should tend to increase—which it probably will do, barring future wars. Yet it is true that gold and silver are not so distinctly in the fields of promotion as the other metals and minerals. Anyone who would like a long-time speculation, or who would like to provide a future for his children and grandchildren, should buy up carefully large deposits of ore and useful minerals which are just too low-grade at the present time to pay expenses, and which therefore can be had very cheaply. And the realization on the investment may happen long before he expects.

Increasing Copper Production

COPPER PRODUCTION in the world is increasing—slowly, it is true, but none the less steadily. During 1925 more copper was mined than in any other year, not excepting the war period; and the rate of production in April, just passed, established a new high record for all time. Thanks to unprecedented consumption by American industry, no large stocks are accumulating; and yet many students of the situation are convinced that if the aggregate production were only a little less than the actual current rate, something like one cent per pound more could be realized on the metal. They argue that profits to any individual company would be greater if it netted 5c. per pound on 900,000 pounds instead of 4c. per pound on 1,000,000 pounds. They contend also that there would be no matedial difference in world consumption if copper sold at 14¼c. instead of 13¾c. per pound. So far as mathematics is concerned, this argument admits of no controversy. As to the effect on consumption, there would be a theoretical tendency to restrict it, but this probably would not be serious.

It is significant that almost without exception the more important companies could produce at a rate 20 per cent or more above their current output. They are not ready to start an era of ruthless competition and precipitate an economic struggle that could only result in putting some of them out of business and inflicting serious injury to all. The big fellows recognize the fact that from a purely selfish standpoint restriction of output is necessary. Why, it is reasonable to ask, if the large producers as individuals limit their output to sustain a 13¾c. market, do they not go a step farther and try, at least, to get 14¼c. To put this theory to the test it would only have been necessary for the leading companies to have continued output approximately at the rate of 1924. A number of them followed this policy to the letter; others increased their output in 1925 by from 10 to 20 per cent. Of course there is no good reason for holding up the 1924 rates as standards of production; and the companies like Anaconda, Phelps Dodge, United Verde, and Calumet & Hecla, that increased largely in 1925, doubtless can give plausible reasons to themselves—for they are responsible to no one else—to justify their action. Anaconda no doubt needs all the copper produced at Butte to supply its wire mills at Great Falls and its brass plants in Wisconsin. It is economically logical to use Montana instead of Chilean copper at these plants. Both Phelps Dodge and Calumet & Hecla, even now, are restricting



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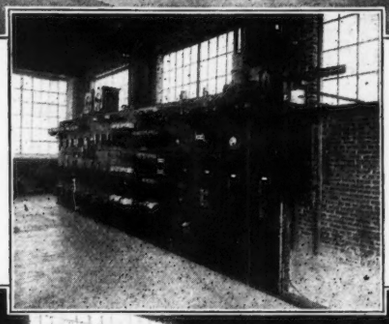

Top—28,940 lbs. rope pull, 2,600 ft. per min. Balanced Cylindro-Conical Drum Hoist with 1,100 H.P., 72 R.P.M. Direct Connected Motor and 300 H.P. Auxiliary Motor.

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wash the grains with water and rub between the fingers or with a piece of soft cloth. If the mineral is cassiterite, which is the only common tin mineral, an unmistakable bright silver-white surface of metallic tin is thus exposed on the grains.

The Practical Necessity for Scientific Methods

MUCH VAGUE TALK and writing is extant concerning the relative advantage of geological theory and practical aid. Analysis of such comment shows that in general what such a critic slightingly calls "theory" is the other fellow's explanation, even though an explanation clearly based on facts; while he regards as eminently more substantial his own explanation, even if not based upon so sound a foundation. There is also a tendency among geologists to turn their backs upon their own science and their own laboratory, which is that which Nature has established and in which she has conducted stupendous and innumerable experiments, the results—whether failures or successes—being open for the eye of the geologist to read: and to dig as deeply as the lack of thorough training will allow, into laboratory physics, chemistry, and mineralogy, ignoring, in short, the evidence of what has taken place to construct in imagination a picture of what should have occurred according to the nebulous perception of fragmentary and half-developed chemical laws and hypotheses.

The result of all this is that many become weary of explanations, and want ore found, without theory. Unfortunately, they ask the impossible. Difficult as the science of metallogenesis is, it has made great strides, and each step forward has made it increasingly possible to apply the new knowledge to practical ends, and thus to aid enormously in the location and economic exploitation of orebodies.

The reason that orebodies are hard to find and to follow is that they are highly localized phenomena; and it is essential to discover the principles which control their localization before any practical guide can be contributed to industry. When, not so many decades ago, it was believed that all rain water, circulating through all rocks, concentrated all ore deposits, that was a hopeless explanation for the miner, who knew that ore deposits did not occur everywhere in all rocks and as a product of all ages. When it was argued that artesian waters concentrated ores from all rocks, the practical test was as discouraging, for artesian waters as a matter of geographical and geological fact have no fixed connection with ore deposits. The discovery of artesian water in any given locality does not raise even a suspicion of a mineral "excitement." When all were agreed that hot springs whose water was of ultimate meteoric origin had concentrated the ores, prospectors and miners hopefully inspected the vicinity of hot springs, past and present, for awhile, and then turned sadly away.

When the close connection of ore deposits with igneous rocks was pointed out, an evident, even if a broad true relation was recognized, and has been used to great advantage in ore-finding. The magmatic origin of ore solutions, and further the connection of an epoch of ore formation with one special igneous intrusion out of a number in the same district, was not only a great forward scientific step, but the practical value of geology advanced in proportion. Finally, the discovery that ore solutions are not igneous universal emanations, but magmatic differentiates injected at definite times, has further narrowed the field, and in each case a study of allied differentiation phenomena and products may not only more clearly explain the history but may further narrow the field to be searched for practical results.

Empirical methods have failed utterly in the past. The method of advance is to establish the true scientific foundation. Search should be for principles, for which, if once found, the practical applications at once become obvious.

In Quest of an Issue

A SURVEY of the mining industries discloses a dearth of "issues." A candidate for the office of guardian of its interests might find himself hard put to it to get himself a platform on which to run. Sound planks are as scarce as other seasoned lumber at the present time. For instance, on what and for what issue would the candidate campaign? The gold bonus is as dead as free silver is, however just, desirable, and comforting to its producers it might be. As for a copper tariff, no one seems less interested in it than the copper men themselves. Flotation litigation, though heard of from time to time, no longer is occasion for the bitterness once displayed and is too diffuse to make an issue. An all-too-gentle quietus has apparently been given to those crying for further "war minerals relief." The proposal to extend the Pittman Act, which recently passed the Senate without a dissenting vote, is from the national viewpoint hardly of the proportions of an "issue," with a mere $14,000,000 or so involved. Taxation can scarcely be an issue, except in spots—it is taken too much for granted. The nearest approach to an issue is made in the question of the conservation of petroleum, and even here Mr. Hughes refuses to see an issue. Thus the day seems to be without a definite issue for which to battle. The atmosphere should therefore be one of tranquility and calm, well suited to approaching summer, with no one inclined to become excited. Who wants an issue, anyway?

Improving Surveying Instruments

SURVEYORS who have done work in cold climates know how unpleasant the handling of instruments may become when the thermometer is low. In the account of their recent dirigible flight over the Pole, the leaders of the expedition, Amundsen and Ellsworth, remark that when flying through the fog it was especially disagreeable to handle navigating and other scientific instruments with uncovered hands. Similarly, work in the tropics may be painful when the hot sun has raised the temperature of the transit to the point where it is too hot to touch. Surveying instruments in general, having reached such a high degree of excellence of design and construction, have shown but occasional improvements from year to year. A recent one remedies the difficulty referred to caused by extremes of temperature. Manufacturers have found that parts made of bakelite, the amber-like resin produced by combining phenol and formaldehyde under heat and pressure, retain a normal feel whatever be the temperature of the atmosphere. At the same time they are sufficiently light and strong, and, in the bargain, can be more easily worked into the shape of the part desired than can the metal customarily used. This is an improvement that many an engineer will appreciate.

output below their equipped capacities to a greater extent than are many others.

But aside from these considerations it is possible that some of the big companies do not feel that an increase in price is either (1) possible or (2) desirable. These apparently conflicting terms are in a sense complementary to each other. The theory is that if the price should show a tendency to climb there would be some stimulation of production, and a possible contraction in consuming demand; whereupon the market would weaken. The net result would be less profit for the company that undertook to restrict output, to the advantage of the company that expanded. Perhaps the philosophy of the increased-production group is to go just as far as they dare without irritating the other group to such an extent that they likewise will expand output on a large scale.

The situation is precarious, and will continue to be so long as there exists equipped capacity to mine, mill, and smelt 20 per cent more copper than the world needs. Fortunately this situation is being corrected rapidly by the increase in consumption. One immediate remedy would be artificial limitation of production by "gentleman's" agreement. That of course would be illegal, and is not to be considered.

To the companies that have maintained uniform or nearly uniform production rates credit is due. It is likely that they have felt that this policy would in the long run make more money than any other for their individual shareholders; and yet their action has helped sustain the market and they have thereby done a service to the industry as a whole. Generally speaking, moreover, they are among those who could survive successfully a "war" of copper producers. Without attributing to the men who direct these companies too much of altruism, it is fair to say that they have done much to bring about the recovery of an industry that was woefully ill only four years ago. Even yet the recovery is not complete. Another year, or perhaps more, of level-headed nursing on the part of producers is needed.

Michigan's Iron-Ore Reserves

"THE DRY STATISTICAL STATEMENT that present merchantable grades of iron ore in the Lake Superior district will become exhausted in about twenty years becomes invested with a lively interest to a vast group of people," according to Dr. W. O. Hotchkiss in a recent speech at Cleveland. Any statement of Doctor Hotchkiss, now president of the Michigan College of Mines and formerly State Geologist of Wisconsin, will be listened to with respect. He is further quoted as adding that, at the present rate of production, Michigan's known reserves of merchantable grades of iron ore will be exhausted in a considerably shorter time than twenty years. However, he says: "There are low-grades sufficient to last for centuries if ways can be found to treat them so they can be used in blast furnaces."

If the reserves of merchantable grades of iron ores will be exhausted within twenty years or less, and there are enormous tonnages of low-grade ores if ways can be found to treat them, then here is a powerful argument for greater attention to iron-ore beneficiation. A word of qualification, however, as to the rapidity with which Michigan's reserves will be exhausted might properly be added. L. P. Barrett, mining geologist and appraiser of mines for the Michigan State Tax Department, in an article in the Sept. 17, 1925, issue of *Iron Trade Review*, told very plainly that between Jan. 1, 1913, and Jan. 1, 1925, discoveries of iron ore in Michigan nearly kept pace with the depletion of deposits. On the former date the estimate of taxable ore was 193,816,904 tons; twelve years later it was 188,198,051 tons, although in the meantime 151,294,808 tons was shipped. "It is impossible," says Mr. Barrett, "to forecast the life of the Michigan iron districts from the sum total of an aggregate of estimates in individual mines. The yearly tax-commission estimate should not be taken as a measure of the life or the total actual tonnage production of Michigan iron mines."

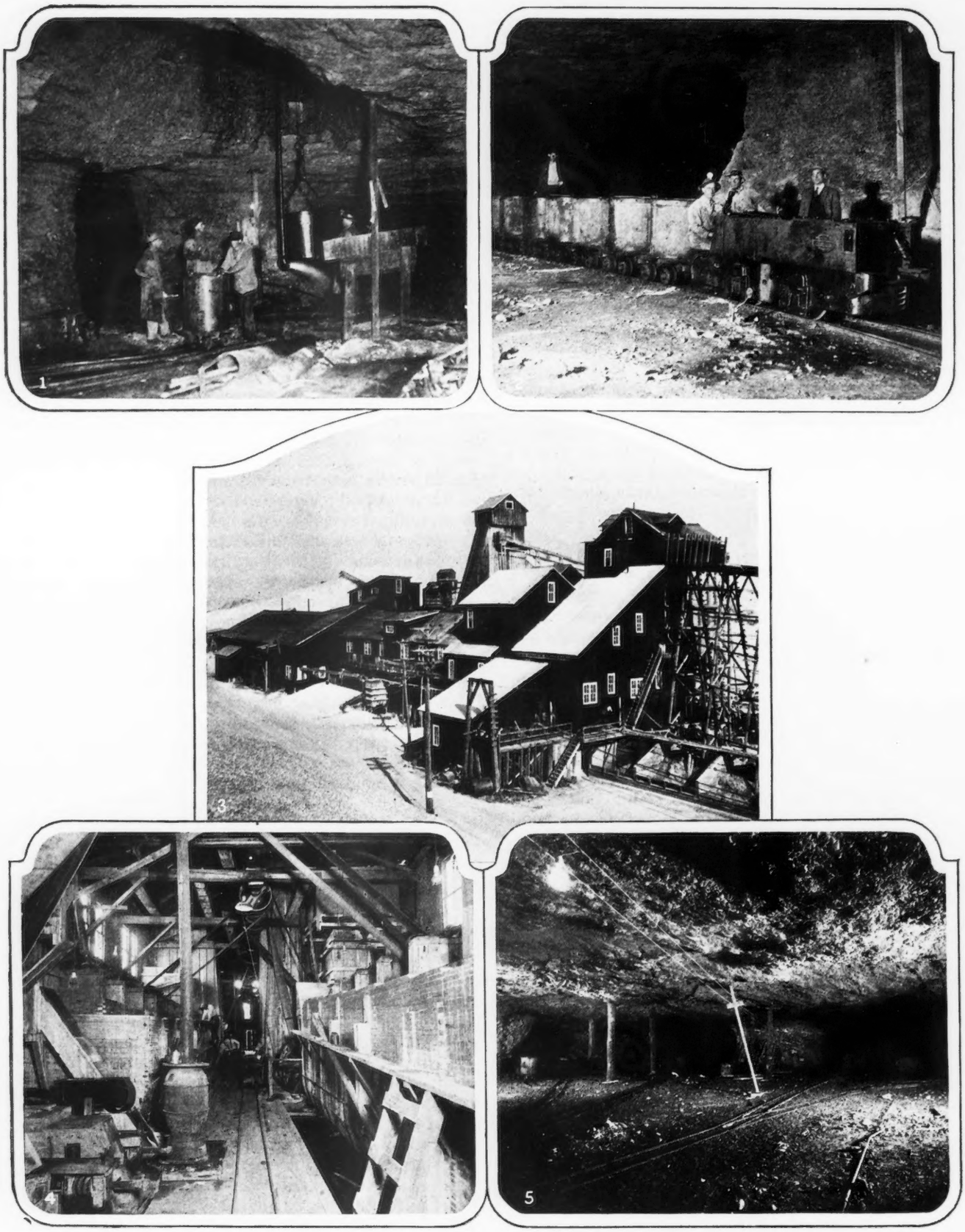
North American Tin Mines

IN SOMEWHAT BELATED RECOGNITION of recent high tin prices, it has been decided, according to reports, to reopen three tin mines in as many states—South Dakota, California, and North Carolina. Possibly there will be some surprise at this statement, in view of the general belief that the United States has no tin mines at all, though so well blessed mineralogically in most other respects. Perhaps "mines" is not the right word; for a mine should contain ore, and ore implies treatment at a profit; otherwise it is only rock. Three tin prospects, then, are to be reopened, though even with tin around 60c. per pound it is decidedly problematical whether any known North American tin deposit can be made to pay.

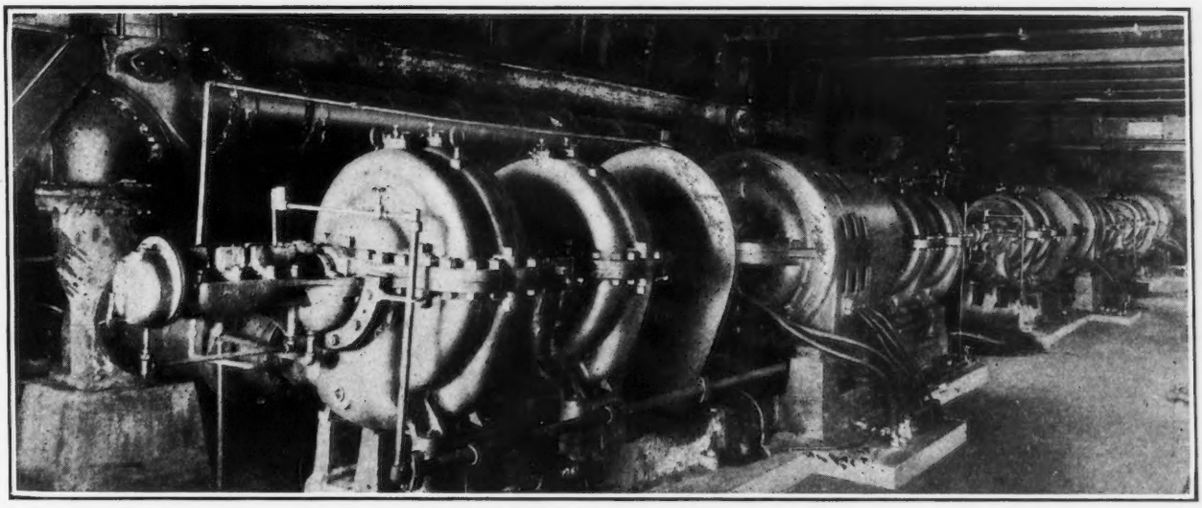
A few tons of placer tin is won every year in Alaska, in connection with gold mining, and a small amount of tin concentrate is recovered from the tables on which the Sullivan ore is treated, in British Columbia; but no other production has been reported on this continent in recent years. The National Tin Corporation has made sporadic attempts at production from its property at Hill City, S.D., but trading in its stock has been more active than operations underground. Another South Dakota company, The Rare Minerals Co., has had perhaps even less luck. Some interest was aroused by discoveries in New Mexico a few years ago, which also apparently came to nothing, and lode tin has been found on the Seward Peninsula, in Alaska. There are, without doubt, a few thin veins of cassiterite in the United States, but apparently nothing that can compare with the comparatively wide fissure veins of Bolivia, where ore containing several per cent of tin can be mined. In fact, there seems little likelihood that any important tin deposits will be found in the explored portions of the North American continent, though it is possible that tin may have been overlooked in some instances by prospectors, as cassiterite is a dark-brown or black mineral with an adamantine rather than a metallic luster and might not be considered to be anything valuable at first glance. It is heavy—almost as heavy as galena—and as hard as quartz, and may be looked for in veins or dikes of granitic rocks, including quartz, aplite, pegmatite, and greisen. In fact, all known tin deposits have come from granite magmas, from which they are one of the final differentiates, and are found at or not far from the contact of intrusive and intruded rocks. Muscovite (white mica), wolframite, and tourmaline are common associated minerals.

A simple and effective test for tin may be worth giving here: Place a few grains of the suspected tin mineral in contact with metallic zinc in cold dilute hydrochloric or sulphuric acid for a few minutes. Then

Typical Scenes in Joplin-Miami Zinc and Lead District



1. Hoisting ore in the shaft—The "tub hooker" at his post. 2. Underground haulage by gasoline locomotive. "Cans" instead of cars are used. 3. A modern plant—The Golden Rod Mining & Smelting Co.'s No. 4 concentrator. 4. The jig room in one of the numerous mills. 5. In the Hunt mine, at Picher, Okla., or in almost any mine in the district



Three automatic centrifugal pumps installed in a large Pennsylvania mine. Each pump has a capacity of 2,000 gal. per minute against 800 ft. head. The motors are 650 hp., 730 r.p.m.

Controlling Centrifugal Pumps Automatically

Manual Attendance Largely Eliminated—Labor Cost Lessened—System Dependable—Applicable to Practically Every Condition of Mine Drainage Where Water Is Handled by Units of This Type

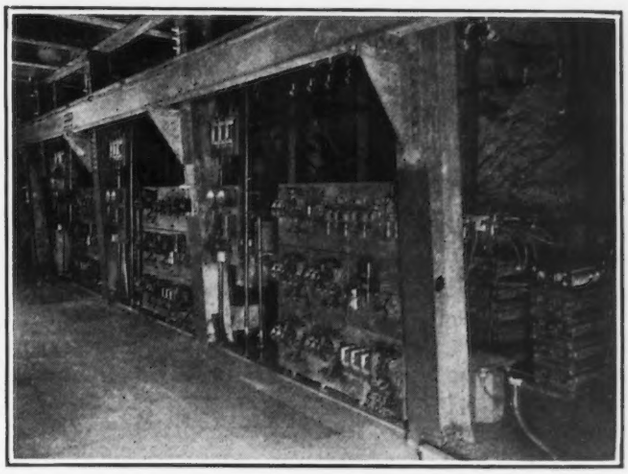
By A. H. Hubbell
Managing Editor

AUTOMATIC CONTROL of centrifugal pumping is an accomplished fact. Although it is more than three years old, many outside of the coal fields where it was developed seem to be surprisingly unaware of this important engineering achievement. A study of its possibilities by those who are now operating centrifugal pumps manually or who are considering their installation should prove at once interesting and profitable.

Elimination of hand labor wherever possible is the tendency of the day. This is accomplished by the adoption of machinery. It is carried a step farther when the machine is automatically controlled. A notion once obtained that the human factor could not be dispensed with, but it is now realized that modern electrical and mechanical devices are often more reliable than the human element.

In the metal-mining industries various instances of automatic control of mechanical operations may be cited. Some of these operations are simple, as are also the controlling devices; others are complex. Electrical equipment offers the greatest opportunity for automatic control, and various devices of a protective nature have been developed, such as the automatic reclosing circuit breaker and the automatic converting substation. Automatically controlled skip loading and ore hoisting, as practiced at Ray, is perhaps the most spectacular demonstration of the success with which hand labor may be dispensed with in a metal-mining operation. Automatic and semi-automatic control of ore lorries or transfer cars between the shaft and bins or stockpile is also common.

The problem of handling mine water is a highly variable one. Some mines are almost dry and others have heavy flows to contend with. Some have acid water and others are not bothered with the problem of corrosion. Some lifts run into several thousand feet and others into hundreds. For all these varying conditions there are many different styles and kinds of pumps from which to choose. In the anthracite fields of Pennsylvania heavy flows are often met: about eleven tons of water is pumped, on an average, it is estimated, for every ton of anthracite produced. In the bituminous fields the average is less than a fifth as large, being about two tons of water per ton of coal. So it is natural that here, where the average pumping expense



Automatic starters and control panels for the three centrifugal pumps shown above

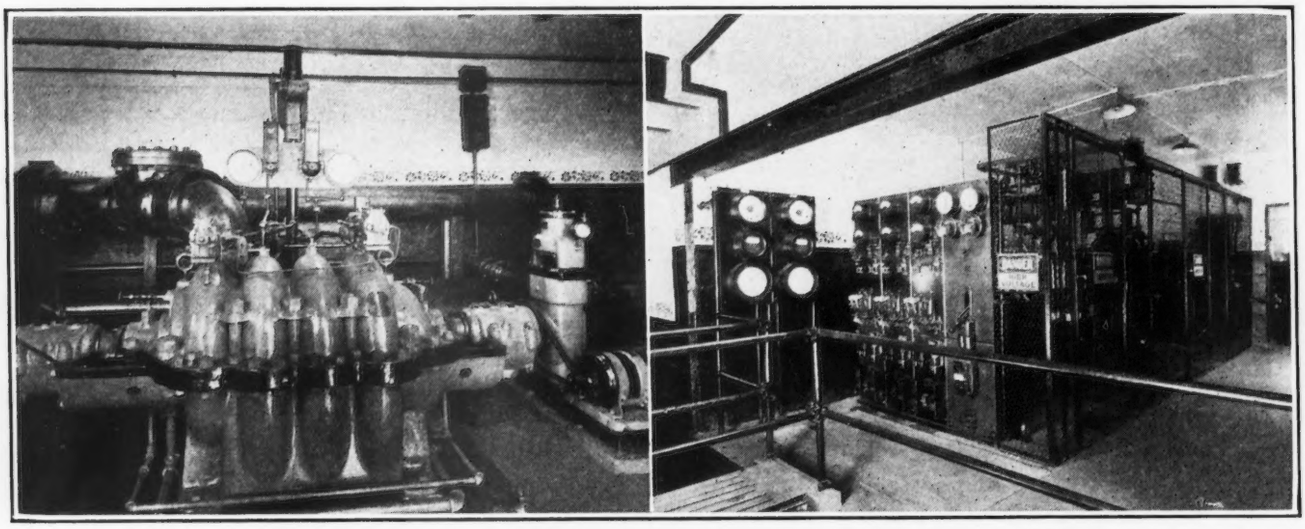
is a considerable item, special study should have been directed toward doing more efficient work in handling water.

Use of Centrifugal Pumps Increasing

A comparison of present-day pumping practice in metal mines with that in vogue ten or fifteen years ago shows a marked increase in the use of centrifugal pumps for handling mine water. Since the single-stage pump of this type develops its maximum efficiency at a very low lift, the centrifugal pump early in the period of its evolution was used only where the lift was low. Furthermore, in its undeveloped state it was often looked upon as unreliable, inasmuch as acid water quickly acted upon the vital parts, affecting the pump's efficiency and resulting in high power cost and upkeep expense and loss of time. Improvements in design and construction were made, and gradually the centrifugal pump proved its value for conditions where large volumes of water were to be lifted against low heads, as in mills and shallow mines. It is not strange that this type of pump made much more rapid progress in coal mines, where the average head is comparatively low—in the neighborhood of 400 or 500 ft.—than in metal mines, where such a depth is considered shallow. With the development of the multi-stage pump, however, and its adaptability to exceptionally high lifts, the field of centrifugal pumping has been greatly widened, and today multi-stage units are active competitors of horizontal and vertical plunger pumps for metal-mine work. The small amount of space that the electrically driven centrifugal pump requires gives it advantage over pumps of the reciprocating type in this respect. It is also cheaper in first cost and in operation.

Automatic control of pumping in its simplest form is by no means new. The use of a float in the sump or tank to connect with or cut off, directly or indirectly, the source of power has long been practiced. By this means the control of the starting and stopping of plunger pumps is comparatively simple. The centrifugal pump, however, presents the difficulty that it must be primed before it will deliver water, unless the water supply flows to the pump with sufficient head to fill the casing. Where the pump is below the water level in the sump or tank the pump casing will be full of water. Pumps of the vertical shaft type, so placed in well or sump that the pump runner is submerged before starting, are self-priming. Horizontal pumps are sometimes installed in water-tight compartments below water level in such position that the pump suction is always flooded. These also are self-priming. In such cases automatic control is confined to starting and stopping.

In many mine installations, however, centrifugal pumps are operated with a suction lift, necessitating priming. The priming may be retained in the casing in some cases by use of a foot valve or sometimes a check valve at the bottom of the suction line. Should this valve leak, however, it must be repaired and the pump re-primed before it will again function. Since the foot valve is also likely to get fouled or be prevented from closing by a chip of wood or other object drawn in with the water, dependence on it may cause the pump to be run at times with the casing empty. In this event the clearance rings and the shaft sleeves, which have very small clearances, will bind, heat, and cut, to the injury of the pump.



Left—One of three 8-in. four-stage automatic centrifugals installed in an underground pumping station. Each unit has capacity of 1,500 gal. per minute and pumps against 475 ft. Right—Electrical control equipment for the three pumps, one of which is shown at the left

Any method of control that is wholly automatic and that is at least a dependable substitute for manual control must first of all provide means for priming the pump when the level of the water in the sump has reached the point where pumping should begin—a point previously determined; also a means of keeping the pump from starting unless it is primed. It should then provide for starting the motor and bringing it up to running speed, and, when this is done, for shutting down the priming pump. To be thoroughly automatic the method of control must also provide means of shutting down the motor in case the pump loses its water, the intake becomes clogged, a leak develops in the suction line, the discharge column breaks, or some similar accident happens.

Despite the wide use of centrifugal pumps, no step to develop such an accident-proof and labor-saving means of control was taken until 1922, when J. T. Jennings, power engineer for the Philadelphia & Reading Coal & Iron Co., suggested it to his company. Rep-

resentatives of the Cutler-Hammer Manufacturing Co., the Allis-Chalmers Manufacturing Co., and the Barrett, Haentjens Co., of Hazleton, Pa., co-operated with him in working out the problem. The circumstances leading up to this interesting development are set forth by Edgar J. Gealy[1] in *Coal Age* for Sept. 13, 1923. Today there are more or less standard systems of automatic control covering practically every arrangement of pumps, piping, and sump. These systems will vary with local conditions, particularly those on the suction side.

In the following text and the accompanying drawings are described the method of operating centrifugal pumps automatically used in two typical cases. The cases are (1) where the water flows to the pump under head; and (2) where a suction lift is used, necessitating the use of a vacuum pump for priming. Credit for most of the illustrations shown is due W. A. Cather, of the Barrett, Haentjens Co., who also supplied much of the descriptive data from which the following is prepared:

When No Suction Lift Is Used

Case 1—When the water flows into the pump under head, the pump is self-priming, so that no provision for priming is necessary in the scheme of control. The other essentials of control mentioned in the third paragraph preceding may be taken care of in several ways. An arrangement of wider application than some of the others is shown in Figs. 1 and 2.

The pump in Fig. 1 takes its water from a dam and is required to start at the high level indicated in the sketch and stop at a lower point, which may be below the center line of the pump. Under these conditions it may be run automatically, if provided with a priming float to start it at the high level, a priming valve connecting the float with the top of the pump casing, a pressure regulator and a vacuum regulator, both of these being protective devices, and an automatic starter for the pump motor. The automatic cycle of operation would be as follows:

As the water rises in the sump it also makes its way up through the pump casing and connecting piping. By the time it has reached the high level mark in the sump, it has also reached the priming float, shown in Fig. 1, which rises, closing a switch and thereby putting the automatic starter into the circuit and starting the pump motor. As the pump comes up to speed the two-way priming valve above the pump (see Fig. 1) is closed by the water pumped into it from the casing. The passages in this valve are restricted, so that although they permit the water to rise slowly through the valve as it rises in the sump before the pump starts, they do not give ready passage to the water pumped in under pressure from the casing when the pump starts. This creates a pressure on the casing side of the valve, which closes the valve against the action of its spring. The priming float is thus cut off from the pump and the water in the float chamber drains off through a port in the two-way valve, leaving the float ready for the next starting operation.

The protective regulators referred to are piped to the pump as shown in Fig. 1, each being connected to its switch in such a manner that if it is brought into action the switch will open and the motor circuit be broken, thereby stopping the pump. The vacuum regulator is piped to the suction side of the pump and is so adjusted that its switch does not open except in the case that the vacuum reaches a point so high as to indicate that the intake is blocked. The pressure regulator is connected to the discharge side of the pump. It has a reverse setting, so that it operates and opens its switch only if the discharge pressure falls below normal, such a drop in pressure indicating either that the discharge column is broken or that the pump has lost its water, or that a leak has developed in the suction pipe or through the stuffing boxes in the pump casing. When such a leak develops, the pump handles a mixture of air and water, lessening the discharge pressure. Thus, when the pump is down, the pressure-regulator switch is open (and the vacuum regulator switch is closed). The wiring diagram of Fig. 2 shows that by the time the pump has built up enough pressure against the priming valve to close it and cause the float chamber to drain and the priming float switch to open, it must have also built up discharge pressure enough to close the pressure regulator, thus establishing a circuit through the two protective devices. Otherwise the pump would stop when the priming float switch opens.

Since automatic control calls for stopping the pump when the water in the sump is lowered to the point desired, some means to do this must be provided. If conditions permit, a float and switch may be installed

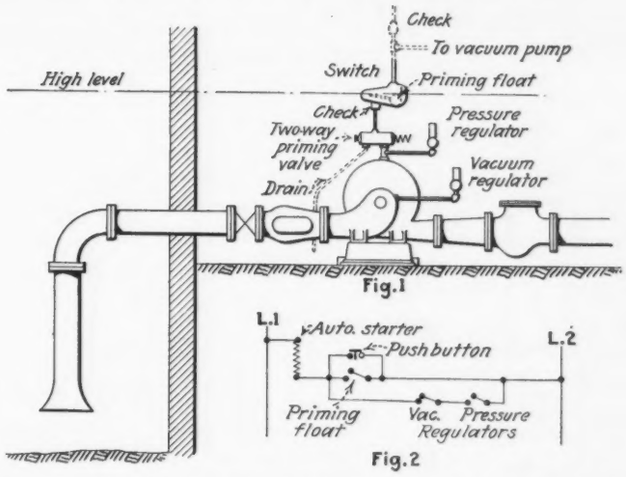
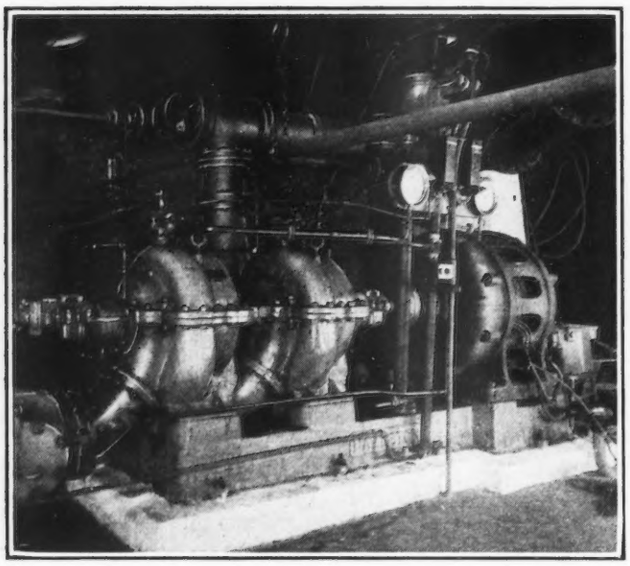


Fig. 1—Sketch showing equipment used for automatic control of a centrifugal pump which receives water under head. Fig. 2—Elementary wiring diagram for the layout shown in Fig. 1

in the sump, by which means the motor circuit is broken when the water has fallen to the point desired. If the float cannot be used, the pump may be allowed to run until the end of the suction pipe is uncovered, or else a hole may be drilled into the suction pipe at the desired low level, at which point the pump will begin to suck air instead of water. In each of these events, the pump will be stopped by the opening of the pressure-regulator switch caused by the drop in pressure.

With the installation as described, the pump cannot be started when the water is below the center line, unless some means of priming, such as a vacuum pump, is used to fill the pump casing. Such a vacuum pump

[1] "Revolutionizing Mine Pumping With Automatically Primed, Started and Controlled Centrifugal Pumps." Edgar J. Gealy, *Coal Age*, Sept. 13, 1923. Also "A Few New Minor Changes Improve Automatic Pumping Service." Edgar J. Gealy, *Coal Age*, March 4, 1926. Also "Recent Improvements in Automatic Centrifugal Pump Control Simplify Apparatus." R. S. Sage, *Coal Age*, March 4, 1926.



A 10-in. four-stage centrifugal pump which is automatically primed and started by either a float switch in the sump or a push button in the hoist house on the surface. There are two pumps in this room each having a capacity of 2,000 gal. per minute against 405 ft. head

is indicated in Fig. 1 above the priming float chamber.

If the casing is full, but the water has not risen high enough to operate the priming float switch, the centrifugal pump may be started (manually) by the push button shown in Fig. 2.

When a Suction Lift Is Used

Case 2—When a suction lift is used, some means of priming automatically, such as a vacuum pump, must be provided, in order to start the centrifugal pump. Objections to a foot valve for this purpose have already been set forth. The equipment called for in case a vacuum pump is used includes (in addition to the vacuum pump) the following: A sump float and switch to start the priming pump at the selected high-water level; a so-called vacuum breaker, which is a float chamber device to prevent the priming water from being drawn over into the vacuum pump and to start the centrifugal pump after it is primed; a priming valve which is closed automatically when the centrifugal pump

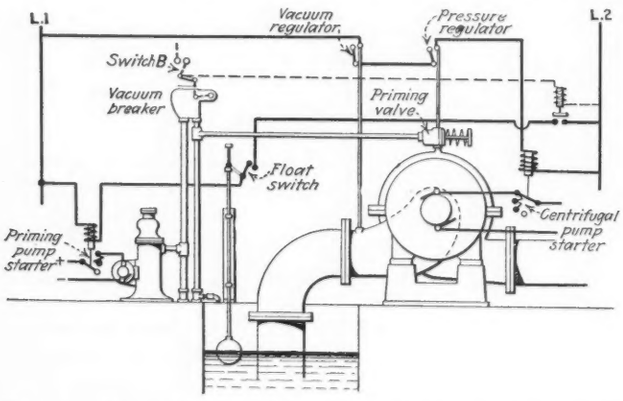


Fig. 3—Showing arrangement of devices and electrical connections in automatically controlling a suction lift pump

starts pumping; a vacuum regulator and a pressure regulator of the types and for the purposes described before; an automatic starter for the centrifugal pump motor, and an automatic switch for the priming pump motor.

Fig. 3 shows diagrammatically the equipment used and its connections. The cycle of operations in this case is as follows: When the rising water closes the float switch, the priming pump is started. This exhausts the air from the centrifugal pump casing, permitting the water to rise from the sump up into the pump casing through the restricted passages of the priming valve and into the vacuum breaker. The float in the breaker is gradually lifted by the water until it closes the switch *B*, thereby starting the centrifugal pump. When pumping begins, pressure is built up on the casing side of the priming valve, shutting the valve, as described in Case 1, but not before sufficient water has been drawn up into the vacuum breaker float chamber (the priming pump is still running) to cause the float to rise still further and open an air valve, which breaks the vacuum (thus keeping the water from going over into the vacuum pump) and causes the float to fall, thereby opening switch *B*. The opening of switch *B* at this stage would shut down the centrifugal pump were not a shunt provided around the switch through the pressure and vacuum regulators. By the time that the switch *B* opens, the centrifugal

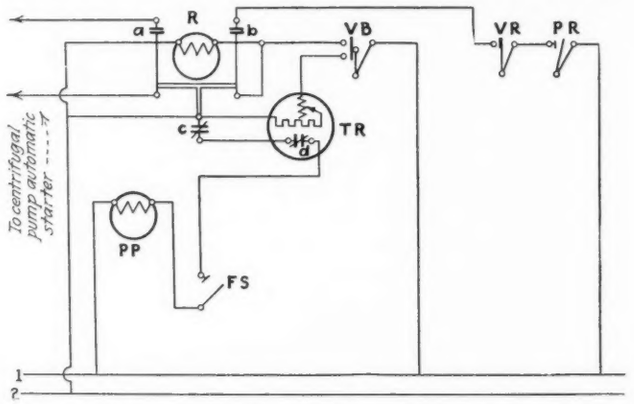


Fig. 4—Diagram of electrical connections for a suction lift pump with automatic equipment. The devices and symbols are as follows:

R is a standard relay having two normally open contacts, *a* and *b*, and one normally closed contact *c*, whose positions are reversed when the coil is energized.

TR is a time relay of the thermal-element type having variable resistance for varying the time required to heat the thermal element to a temperature high enough to open the normally closed contact *d*.

VB is the vacuum breaker switch with a double contact. One connection leads to the relay *R*, the other to the relay *TR*. *VR* is the vacuum regulator. *PR* is the pressure regulator which opens its switch with subnormal pressure on the diaphragm. *PP* is the priming pump motor starter, and *FS* the float switch.

pump has had a chance to come to speed and develop pressure enough to close the pressure regulator, thereby completing the shunt circuit through the protective devices.

Fig. 4 shows diagrammatically the electric connections for a suction lift pump with automatic equipment. The sequence of events in starting is as follows: The float switch closes, due to high water in the sump. The current passes from line 1 to line 2 through *PP*, *FS*, contact *d*, and contact *c*. When the centrifugal pump is primed, the vacuum breaker switch is closed; the current then goes from line 1 to line 2, through *VB*, and the coil of *R*. Coil *R* being energized, the posi-

tions of contacts *a*, *b*, and *c* are reversed. With contact *c* opened, the priming pump circuit is broken and this pump stops. The operating circuit is then through *VB*, and the coil of the relay *R*. By the time *VB* opens, the circuit is carried through *VR* and *PR*. If either *VR* or *PR* opens, the coil of *R* is de-energized, the centrifugal pump is shut down and the coil can be energized again only by repeating the priming operation and closing *VB*. Should the unit be repeatedly started and stopped through some cause, the current will flow through the thermal element of *TR* until the element heats up to a point where *d* is opened and locked out, and the pumping system cannot be started again.

When the vacuum is broken in the vaccum-breaker float chamber, the water in the chamber drains through an orifice into a pipe terminating in a check valve.

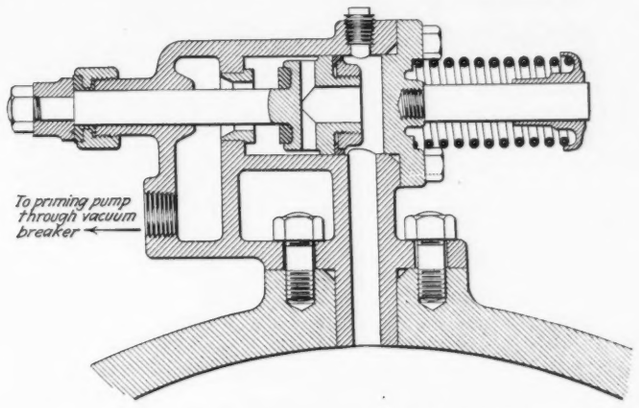


Fig. 5—Showing construction of the priming valve

Air can easily pass through the openings in the valve, but when the pump delivers water into the valve the restricted openings cause a higher pressure to be built up on the right hand side of the valve than exists on the left side and the valve is closed against the adjustable spring pressure. The two-way valve used in the arrangement shown by Fig. 1 operates on the same principle, but has an additional valve on the stem, which extra valve opens the drain connection to the priming float as the connection to the centrifugal pump casing is closed.

The priming-pump motor is disconnected through a relay on the control panel when the centrifugal pump comes up to speed.

The time relay of the thermal element type is provided in the same circuit as the vacuum-breaker switch. If this circuit is maintained too long, or is made and broken too often within a short period, the heating element of the relay will get hot and open the circuit, which can then be closed only by hand. The relay has a variable resistance unit which can be set to govern the time required to heat the thermal unit to the tripping temperature in any given installation.

Advantages of Automatic Control

From the foregoing it will be seen that automatic control of pumping offers several advantages. The chief of these are automatic priming and starting, and in case of an accident or any one of several improper operating conditions, automatic stopping. An ignorant or careless pump man can very easily damage a centrifugal pump by continuing to run it after something has gone wrong, particularly when it has lost its priming. The variable and undependable human element is eliminated by automatic control. The control described has been found to be safer than manual operation during the three years that have elapsed since it was devised. Besides, it is cheaper to operate. A daily inspection

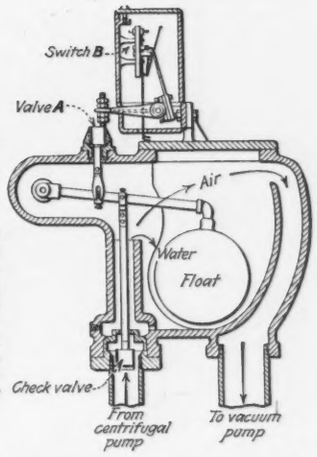


Fig. 6—Interior construction of the vacuum breaker

When the pump is primed water is drawn up into the float chamber and the float rises. After the float rises to a certain height the valve *A* is opened and air is admitted to the chamber, thus breaking the vacuum. When the float rises it also closes the switch *B*, which completes the starting circuit for the main pump motor.

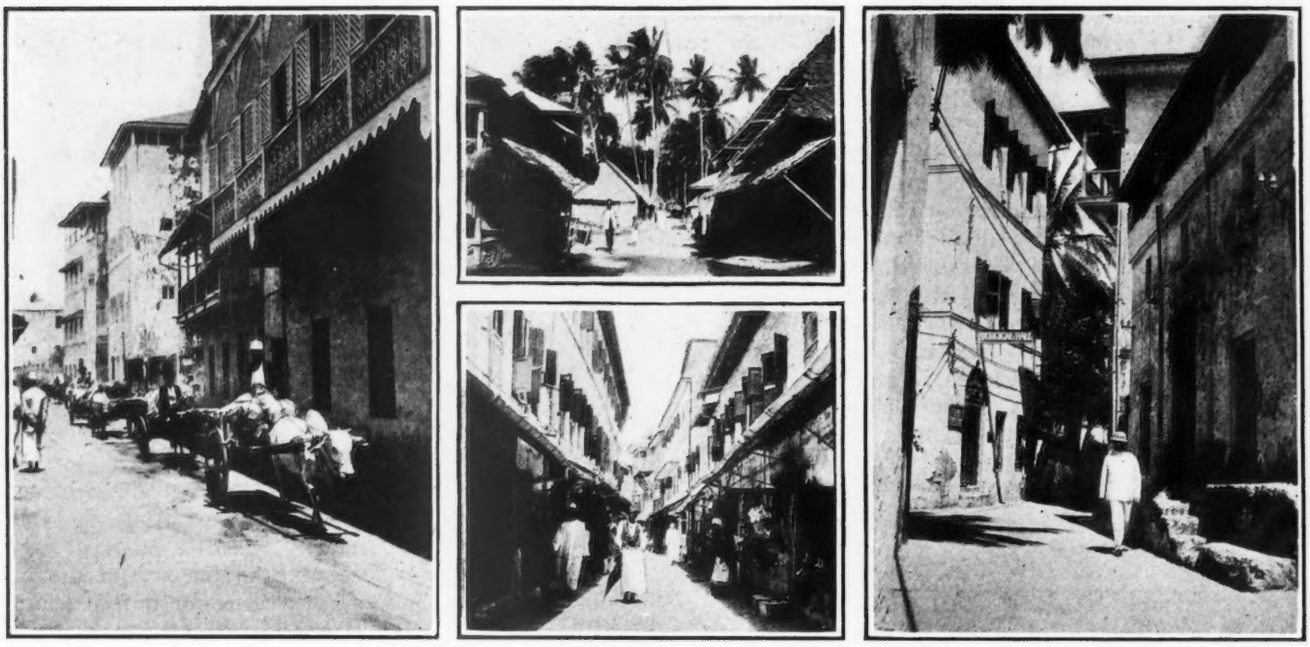
by the electrician suffices to keep it in order, whereas with manual operation the labor cost would be considerably higher. The amount saved in labor expense will vary, of course, depending on the size of the installation and on the number of hours daily that pumping is done.

Since 1922 a large number of automatic centrifugal pumping units have been planned, many of which are now running, and, it is said, successfully. From the time that this control system was first devised, very few improvements were made in it until recently. These latter improvements have been both in the system used and the apparatus employed, particularly in the method of securing successive restarts of the pump. The circuits, it is said, have been somewhat simplified and the dependability of the system in general has been increased.

Electric Rock Drills Tried in Homestake Mine

Electrically driven rock-drilling machines have been tried experimentally several times by the Homestake Mining Co., of Lead, S. D., according to J. F. Wiggert in *The Black Hills Engineer*. They are more economical in power consumption per foot of hole drilled than the air machines, but their over-all efficiency was much less because, though they required the same amount of labor to operate, the number of feet drilled per day per machine was much less. In addition they were more expensive, heavier, and, because of the nature of their construction, they had to be handled more carefully.

Electric haulage in the mine has been considered, and, though the power required per ton-mile would be less than that needed for air locomotives, the additional expense incidental to the operation of the electric installation would be much more than the cost of the power saved. To one not acquainted with the mine this may seem strange, but the conditions will be understood when it is explained that there are many miles of track, all of very narrow gage (18 inches), and much of the track not regularly used, but which must be maintained for use at any time, as the haulage routes are changed. With a trolley system this would mean much bare wire that would need to be installed and maintained in a safe and substantial manner. It would also require an extensive feeder system and quite a number of motor-generator sets for a mine of so many levels, each of great extent. For so large a haulage system of very narrow-gage track storage-battery locomotives were considered unsuitable.



Scenes in Zanzibar and environs

A Journey to South Africa—VIII

Zanzibar: Its History—The Slave Trade—Oriental Life—Spices, Lost Baggage—Mombasa, Aden, The Red Sea, and Suez—Cairo—Alexandria—Venice

By T. A. Rickard

ON MAY 23, 1925, we sailed on the "Kalipha" from Dar-es-Salaam, on the east coast of Africa, to Zanzibar, on the island of that name, separated from the mainland by a channel 30 miles wide. We left at 11 a.m. and arrived at 4 p.m. It was a smooth passage, and we were in sight of coral islands or of the mainland itself all the way. On rounding an island, on which stood a lighthouse, we had our first glimpse of Zanzibar, with its white-walled houses on the water's edge amid the coconut palms. We were rowed ashore by an Arab crew, and we were welcomed, as usual, by a mob of natives clamoring to carry our baggage. Proceeding on foot along the narrow, winding alleys to the hotel, we noted the cleanliness of the town, once a byword for filthiness. David Livingstone, writing in 1866, said: "The stench arising from a mile and a half or two miles square of exposed sand beach which is the general depository of the filth of the town is quite horrible. At night it is so gross or crass one might cut out a slice and manure a garden with it; it might be called Stinkibar rather than Zanzibar. No one can enjoy good health here." All that has been changed since the British took hold. The narrow streets are remarkably clean. One detects only the pleasant perfume of cloves, the chief article of export, and the sickly smell of copra, the dried kernel of the coconut. An ample supply of excellent water is pumped from a spring three miles distant, in the interior of the island —a spring that is believed to draw its water from the mountains on the mainland.

Our hotel, "The Africa," was once an Arab palace; it has crenulated arches and white walls loopholed for guns; like most of the larger buildings in the town it has a handsome door of carved magogany in which are set big brass spikes, placed there originally to frustrate the elephants that used to be employed for forcing an entrance in the old days of rapine and loot.

The Arabs began their trade with the aborigines of Zanzibar so long ago as the seventh century B. C.; it was they that started the exportation of slaves to Mesopotamia and Persia. Later they came in conflict with the Portuguese, who, in 1503, captured twenty ships richly laden with ivory, tortoise shell, wax, and ambergris. From that time forward for centuries the Arabs and the Portuguese struggled for control of the island and of the adjacent coast, which was tributary. From the close of the seventeenth century the Arabs of Oman, or Muscat, at the entrance of the Persian Gulf, ruled the island and established an independent empire, which was recognized by the European powers in 1862. The slave trade was flourishing then. Livingstone, who made several visits to Zanzibar at about that time, writes: "On visiting the slave market I found about 300 slaves exposed for sale, the greater part of whom came from Lake Nyassa and the Shiré River. All who have grown up seem ashamed of being hawked about for sale. The teeth are examined, the cloth lifted up to examine the lower limbs, and a stick is thrown for the slave to bring, and thus exhibit his paces. Some are dragged through the crowd by the hand, and the price called out incessantly; most of the purchasers are northern Arabs and Persians." We saw the stanchions to which the slaves used to be tied. In 1873, the year in which Livingstone died, after a persistent effort to expose the horrors of the slave trade, the Sultan entered into a treaty with the English, represented by Sir Bartle Frere, to abolish the inhuman traffic, which, however, lingered until the island passed under British rule, in

1890. On the site of the old slave market now stands the cathedral of the Universities Mission.

Our party of three was much interested in the Oriental phase of Zanzibar; we enjoyed the play of life and color, African, Indian, and Arab. We wandered curiously along the narrow streets and caught strange glimpses of unfamiliar ways: humped cows in a stable, five blindfolded camels turning machines for grinding copra, Cingalese engaged in carving ivory elephants, alcoves in which queer nuts and fruits were offered for sale.

It was but a step from the crowded alleys and the rabbit-warren of mysterious interiors to the open shore, to the white coral beach, the fishing boats, the fringe of palms, and the laughing sea. At evening we saw the mosques, some of them inconspicuous buildings, in which, kneeling on a mat, prone upon the floor, or standing upright, the devout Mohammedan mumbled his prayers. In the streets were many native women robed in the black *boi-boi* and veiled in Moslem fashion. Indians were numerous, from Bengal and the Punjab; those with the red mark on their foreheads were devotees of a saint named Kali. The Swahili native, a hybrid of Negro, Arab, and Portuguese blood, wears a white cap and a cotton smock that reaches to his ankles. The hotel proprietors are Greeks, the clerks are Goanese, from the Portuguese colony of Goa, on the southwestern coast of India; these are Eurasian in race and Romanist in religion. The population consists of 270 Europeans and 113,000 Asiatics and Africans. The Arabs of Zanzibar are descendants chiefly of the pirates of Muscat (to the Spaniards Sir Francis Drake was a pirate; it depends on the point of view), who dispossessed the effete Portuguese in 1698. The Sultan of Zanzibar's rule used to extend as far as Lake Tanganyika, until, in 1884, Dr. Karl Peters and other Germans made treaties with the native chiefs of East Africa. In 1890 Lord Salisbury obtained a protectorate over Zanzibar in exchange for Heligoland. Britain is now represented by a Resident, and the Sultan has been pensioned. We saw both of them, in elegant equipages, on several occasions. The island is 50 miles long, and its biggest width is 27 miles; the rock formation is coralline, on beds of sandstone. Zanzibar is equidistant from the Cape, India, and Suez; hence its strategic value.

One afternoon we went by motor car to Chuaka, 20 miles away, on the opposite shore of the island. The road goes through a long series of clove plantations, in the form of bushes 25 to 30 ft. high, growing among coco and banana palms. We strolled along the coral strand to the rhythmic wash of the Indian Ocean. On our way back we visited the government gardens, where all sorts of spices are grown, including clove buds, cinnamon bark, nutmeg nuts, coffee berries, cacao (or cocoa) pods, the leaves of the incense tree, breadfruit, avocado (alligator pear), custard apples, and pawpaws. We returned at sunset, in perfumed air, the tall palms silhouetted against a crimson sky.

During a stroll to the park and golf course on the outskirts of the town I noticed a milepost that gave the distance to London as 8,064 miles. A priest talked with us, deploring the cinemas, chiefly American, that told tales of violence and crime. I ask the reader to consider the effect of the ordinary second-class moving-picture show upon the ignorant natives of these remote parts of the world. What must an Arab or a Swahili, but recently disciplined into orderly conduct, think of the scenes purporting to represent the life of an American city? We ought to have an export censorship on movie films, if for no better reason than to protect our own reputation.

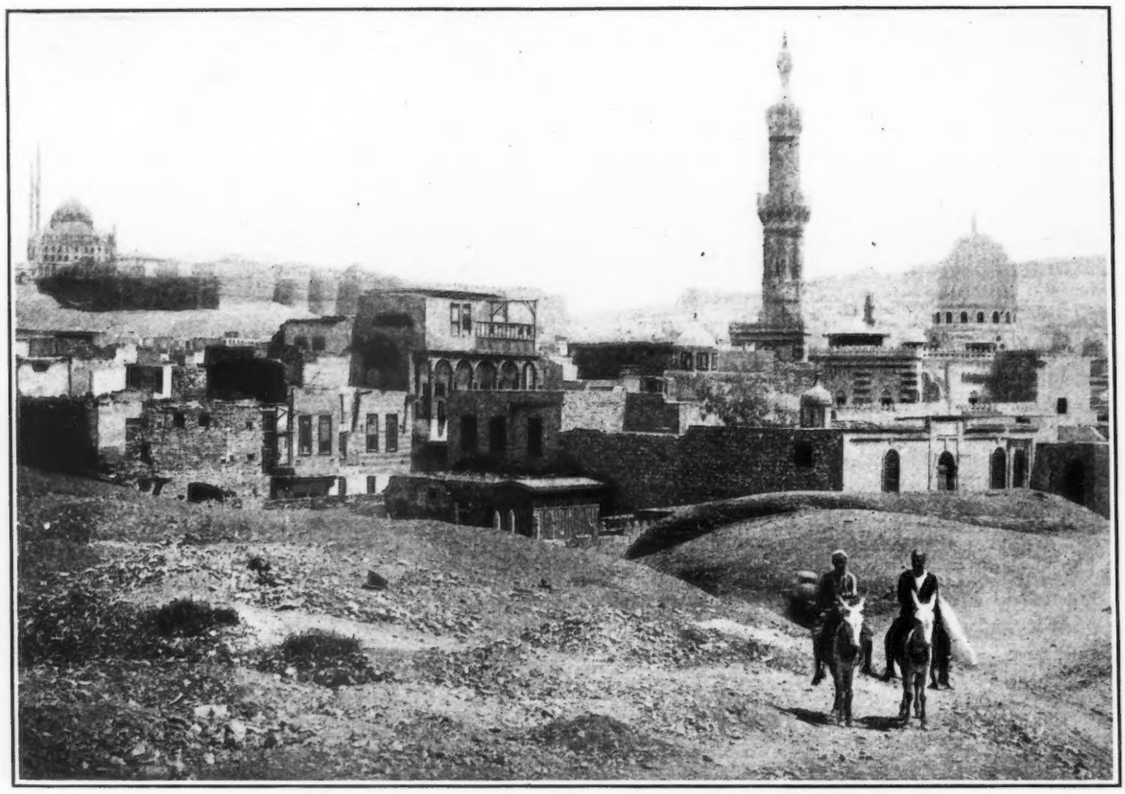
We had been five days at Zanzibar when I decided to leave my friends and return to Dar-es-Salaam for the purpose of recovering two trunks that we had lost after leaving the steamer on the Congo. Those wretched pieces of baggage had risen repeatedly like a Banquo's ghost to spoil the fun, and chiefly mine, for I was technically responsible, having taken the receipt from the railroad agent at Bukama. We had spent a small fortune in telegrams, apparently without success, when on the afternoon of May 24 we received a message that they had arrived at Dar-es-Salaam. To make certain that they would be put on the Messagerie steamer, I decided to go thither. So in the afternoon I boarded the "Llanstephan Castle," the best-equipped ship sailing along the east coast. It was a delightful change to find oneself among Europeans, away from the ill-smelling natives, and in enjoyment of the comforts of our civil-

ization, including skilful service. Moreover, the short voyage, by night, was made during the first comparatively cool spell I had been able to enjoy for weeks, so I had a good sleep. Such small matters loom large to the traveler. I landed at 10:45 a.m., and went promptly, in a rickshaw, to the office of the agent, and there found the missing trunks. They looked pretty as a picture! A delightful dinner with Colonel and Mrs. Maxwell made that evening memorable. Next morning at 5 a.m. I went aboard the "General Voyron," of the Messagerie Maritime company, and on arrival at 1 p.m. at Zanzibar my two companions joined me.

Two hours later we sailed for Mombasa, on our way to Suez. The weather continued hot, 85 to 90 degrees, plus humidity. A sickly smell of copra came from the forward hatches. The "General Voyron" had come from Tamatave, in Madagascar, and among her other passengers she carried a company of 250 bare-footed Malagasy soldiers on their way to Europe. It seemed regretable that these natives of Madagascar, only once removed from savagery, should be used for military purposes by the government of a highly civilized (perhaps

the most civilized) country. The officers were our fellow passengers, of course; the wives of two of them were native women; but this did not seem to cause any social trouble. We reached Mombasa at 9 o'clock next morning, June 1. This is the port of entry for Uganda and the Kenya Colony. We cast anchor in the harbor of Kilindini, on the south side of the island, which is connected with the mainland by the railroad bridge. We saw the old Jesus fort, built by the Portuguese in 1593, and captured by the Arabs in 1698. Mombasa deserves its native name, Kisiwa M'vita, or Isle of War, for it has been the scene of much fighting, the last serious affair taking place in 1896, when a Swahili chief rose in rebellion against the Sultan of Zanzibar and attempted to defy the British. He was forced to flee into German East Africa. Nowadays Mombasa is a thriving port, for it handles all the forwarding trade with the interior, more particularly the highly prosperous British colony of Kenya.

Leaving Mombasa our course northeastward followed the coast, of which we obtained occasional glimpses, most unattractive, for the Somali shore is desert. We arrived at Aden on June 6, at 3 p.m. The distance from Zanzibar is 1,733 miles. This port is situated at the base of a grim and barren rock of volcanic origin. It was hot as Tophet. The lava cliffs made the setting for a picture of Hell; however, inaction was worse than movement, so we went ashore, and proceeded in a Ford car to the famous tanks. These, cut in the solid rock, are supposed to be ancient, but they have been improved by the cement lining given them by the British, to whom this Arabian port belongs. We returned through a tunnel lighted by oil lamps and paved with camel dung. On our way we saw a cantonment of Indian troops and the camp of the camel corps. That evening we dined at the Royal Hotel, but, before sitting down with a group of fellow voyagers, we paid our tribute to a first-class fake, the so-called mermaids, to see which we had to pay admittance. They are kept secreted in chests, and are nothing more than dugongs, fish-like mammals found in the Indian Ocean. The fake mermaids of the western hemisphere usually are manatees, which are fresh-water mammals. After dinner we strolled through the Arab bazaar, and at 11 p.m. we went aboard, where we found coaling in progress.



Old Cairo, showing the Citadel and the Mamelouk tombs

The coal was carried from the barges in sacks by Arabs up a gangway to the measure of a chanty; behind this lively foreground was the grim silhouette of volcanic hills, the lights of the port, a velvet sky, and a sweltering heat. I could not sleep until near dawn; this experience was repeated night after night, but it is surprising how little sleep one needs when inactive. Since leaving Albertville I had been taking ten grains of quinine, but now I reduced it to five, and before we reached Suez we three stopped the daily dose entirely—and not too soon, for it affected my memory, so I thought, and made me play bridge like a drunken sailor!

From Aden we proceeded southwestward to Jibuti, in French Somaliland, arriving there at 10:30 p.m. the next day. The usual pedlars came on board, with amber, ivory, and Indian shawls. Several boys, again as usual, dived from the upper deck when silver coins were thrown into the pellucid water. The Somalis, some of whom we had already seen at Aden, are truly Ethiopian, with better features than the Swahili half-breeds, and more truculent, because they have never been subjugated. We left Jibuti at 9.30 a.m., on June 6, and passed Perim in the afternoon. Perim is a fortified island belonging to the British; it commands the straits of Bab el Mandeb, the entrance to the Red Sea. At sunset that day the reflection of red clouds

made the Erythrean sea, as the Greeks called it, true to its name. By force of contrast the water ahead looked green and the foam pink. A slight breeze from the north made the air cooler than it had been for many days. On June 12 we awoke to see the red cliffs of the Nubian coast rising from a cool blue sea. The change of temperature was delicious, especially to those who had been suffering from prickly heat, a rash due to excessive perspiration. We were now entering the Gulf of Suez and passing the entrance to the Gulf of Akaba, on the upper reaches of which once stood Eziongeber, the port whence, three thousand years ago, the ships of Solomon went to Ophir in quest of gold, sandalwood, and peacocks. Where was Ophir? I think I know; but that is another story, and it might lead to long disputation. Soon we had the rocky coast of the Sinai peninsula on our starboard; it was noteworthy that the sand had been blown so as to fill the gullies to a height of 1,000 ft. above the seashore. Sinai again is a name full of the romance of ancient mining, for here the Egyptians obtained copper five thousand years ago, as is attested by inscriptions on the rocky walls of the "wadis," or dry gulches. These must have been immune from the sand-storms that blow along the coast; otherwise the inscriptions would have been obliterated long ago. In the afternoon we had barren hills and a blistering shore on either hand; it made one feel content to be on the water. A fierce sandstorm was blowing.

We arrived at Suez at 5 p.m. on June 11, the distance we had come from Aden being 1,620 miles. The air was positively chilly, by contrast with the tropic heat we had endured so long. The canal is 101 miles long and from 60 to 150 yards wide. The tide of the Indian Ocean rises and falls five feet; at the Mediterranean end the tide is barely perceptible. We spent most of the next day moving slowly along this big ditch that separates Africa from Asia. We watched the works of repair in progress, by aid of men, mules, and a tram-road; and we noted the parts that had been finished with stone and cement. A big dredge was removing the silt far afield through a long line of pipe. Two Arabs trotted on camels along the canal. A long train passed us on the parallel railroad. At Cantara, 30 miles from Port Said, the sweet-water canal begins to appear; this brings water from the Nile. During the war it was piped into Palestine, and was an important aid to the military operations, that, under General Allenby, broke the Turkish hold on the Holy Land. We saw the remains of a big military camp and of the bridge by which the railroad used to cross the canal. On arrival at Port Said, at noon, we disembarked after the *dejeuner*. We had traveled 3,440 miles since leaving Zanzibar, and had spent twelve days on the voyage. I was not sorry to leave the "General Voyron," for the service was not as good as I had reason to expect from former voyages on the Messagerie ships; the heat and the poor food were factors of discomfort. The "Voyron" is an ex-enemy ship and has ugly German decorations; for example, the smoking room is paneled with marble slabs like a lavatory. However, such experiences are an essential part of a long journey, and one can afford to look back upon them with equanimity.

A representative of the Casino hotel steered us comfortably through the customs and immigration offices at Port Said. We strolled along the pier to see the statue of De Lesseps, the builder of the canal. It bears the inscription, *aperire terram gentibus*, to "open the earth to the peoples." Later we went to several steamship offices in an effort to obtain suitable reservations on some ship sailing from Alexandria within a week, for we planned to visit Cairo first. The result of our inquiries was disappointing, for it was just the time when everybody leaves Egypt for the European resorts. Then we hired a caleche and drove about the town. It looks prosperous. Many new houses were being built. At 6:15 p.m. we left by train for Cairo, arriving there four hours later. The railroad follows the sweet-water canal and the Suez Canal itself as far as Cantara. We saw three ships going the way we had come. An Ismailia we left the Suez Canal but continued to follow the sweet-water canal. Ismailia showed many signs of prosperity in the shape of handsome new houses. We had an excellent dinner on the train, with some good French wine and Corona Coronas. So does one rough it in these distant parts! On arrival at

Natives of East Africa

Cairo, we went to the Hotel Continental, where I found a telegram from Salib Claudius Pasha, my sister's husband, inviting me to visit them at Alexandria. A fresh-water bath and a comfortable bed seemed the height of luxury. At breakfast the coffee was delicious. We spent most of the morning at the steamship offices.

In the afternoon we made the usual trip to see the Pyramids at Gizeh. I had seen them several years ago, and this second visit was spoiled by the persistent solicitations of the camel drivers, curio sellers, and pestilent beggars of all sorts. Our guide was an ignorant fool, who made the Blue Nile rise in Algeria instead of Abyssinia! The change of government during recent years, and the native control of the police, may explain the truculent manner in which travelers are pestered by pedlars, beggars, and would-be guides. The result is to make the visit to the Pyramids ridiculous. All the sentiment of this memorial of antiquity

is spoiled by the importunities of a mob of unruly natives. However, I am frank to confess that there was not much sentimentality to be dissipated on my part, because the Great Pyramid of Khufu is to me a monumental folly erected by an ignorant Pharaoh to his own glorification. As for its age, I picked up a bit of coral limestone at the foot of the monstrous tomb, and as I looked at one of the little polyps in his own self-made tomb of stone, and realized how vastly more ancient he was than the Egyptian monarch, I ceased to be impressed by the mere ugly bigness of the pyramid. The true monument to the greatness of Egypt lay outspread before me—the beautiful valley of the Nile, made increasingly fertile by human intelligence for six thousand years.

I left Cairo on the morning of June 15 on my way to Ramleh, near Alexandria, to spend three days with my sister. The journey down the Delta was interesting; the intensive cultivation was impressive; little heaps of nitrate indicated the need for fertilizing the soil now that the inundation is so controlled as to bring less silt than heretofore. The Delta is 120 miles long by 70 miles wide, the last 30 miles, approaching the Mediterranean, being a morass. No Nile water reaches the sea during the four dry months of the year; it is all stored and used.

My brother-in-law is of pure Egyptian stock and a Coptic Christian. The Copts have been Christians for twelve centuries. I had never met him before, and I am frank to say that we became good friends at once. He is a Senator, as well as a Pasha, having done notable service to the State. The next afternoon my sister and I went to the races, where we saw some exciting tent-pegging by groups of four horsemen representing various regiments, British and Egyptian. The Egyptian police tied with Battery J of the British artillery, the latter winning eventually by a small margin. A musical ride by the King's body-guard was well done. We had tea with Judge and Mrs. Henry, Americans. That evening we dined with Fahmy Wisa Bey and his talented wife, both pure-bred Egyptians and devout Christians of the Coptic sect. Our host was a graduate of Oxford, and he had been made a Senator on account of the political services of his accomplished wife—a handsome and vivacious lady. The house, the dinner, the service, and the conversation were of a quality to make the occasion highly memorable. We talked of national politics. My hosts, of course, deplored the recent assassination of the Ciradar, or British military chief, as a hideous crime, and recognized the fact that it had hurt the National party, whose leader, the Premier, Zaghloul Pasha, is an able man, but somewhat lacking in political sagacity. Here I may explain that Egypt before the war was under the nominal suzerainty of the Turkish Sultan, but under the military occupation of the British. When Turkey joined our Germanic enemies, Egypt became a British protectorate, chiefly, of course, to safeguard the Suez Canal. This protectorate was contested after the war by the Egyptians on the basis of self-determination, the piece of political dynamite that Woodrow Wilson threw into the chaos of after-war conditions. British officialdom was distasteful to the Egyptians, because there was too much of it. Unfortunately, during the war, requisitions for labor and provisions were made on the Egyptians somewhat arbitrarily, through Egyptian sub-officials, in a manner unavoidable perhaps when the country was in a state of war, but nevertheless irritating to the native population. In 1922, on the report of the Milner commission, the protectorate was withdrawn, with reservations, and the Sultan of Egypt was made King. A constitution was promulgated, and the British representative became a High Commissioner, supported by a military force, which was needed to maintain order. The High Commissioner was General Lord Allenby, the conqueror of Palestine; he left Egypt during my stay at Alexandria, to be succeeded by Sir George Lloyd, of the Lloyds insurance agency. Allenby's administration had not been wholly successful, for reasons I need not discuss. Usually a soldier does not make the best political administrator in a country where an attempt is being made to develop representative government. The pres-

A village in East Africa

ent king, Fuad, is a grandson of Ismail Pasha, the clever and extravagant Khedive who presided at the opening of the Suez Canal fifty years ago. The Premier, Zaghloul Pasha, has suggested that the Suez Canal be placed under the control of the League of Nations or be protected by Egyptian troops, both of these suggestions being obviously unacceptable to England, which cannot take the chance of having the canal put in jeopardy.

The Egyptians have two grievances. They assert that educational methods are planned deliberately to keep the native subservient, and they complain that the government in London does not give the educated natives a fair chance to learn the art of administration by allowing them the minor offices, which today are filled with the sons and nephews of British dignitaries. This was done excessively after the war, when England was full of unemployed young men suddenly demobilized from the army. Another grievance is the control of the Nile water. The barrages, or dams, at Assuan and Senaar, conserve the flood-water, but they check the spread of the sediment to which the valley of Egypt owes its remarkable fertility. The new dam at Senaar holds the water of the Blue Nile for use in the Sudan, but utilizes only the water that otherwise would run to waste during the season of flood. Egypt is the gift of the Nile, it is true, but modern Egypt is undoubtedly the beneficiary of British rule. The peasants, or fellaheen, are no longer under the lash; the precious water of the Nile is no longer wasted; the people are most prosperous. Anyone familiar with the condition of Egypt before the British took control must acknowledge that the results have been highly creditable to the foreign administration of what was then an extremely backward country. England has made good, and any unprejudiced American will be quick to give the proper credit. Egypt, as Herodotus said, is a land of paradox. The Mohammedan in Egypt shouts "Egypt for the Egyptians," but he is no true Egyptian; until recently he boasted that he was an Arab. Young effendis sent telegrams to Paris and Berlin asking for the exclusion of the "English infidel"; their loyalty is not to Egypt, but to Islam. The so-called Egyptians of Cairo and Alexandria are mongrels; in their veins flows the blood of the successive invaders, Greeks, Arabs, and Turks. Alexander conquered Egypt and founded Alexandria in 331 B. C.; the Romans ruled the country from 30 B. C. to 313 A. D.; the Arab conquest was in 641, and the Turkish in 1517. The true Egyptian is of Pharaonic stock and of Coptic religion. Of these there are a million in a whole population of fifteen millions. These are quiet, reasonable people, who realize that Egypt is not yet ripe for self-government and are willing to live under British protection if only the government in London will give the younger people a chance to be educated without limitation and give them an opportunity also slowly to acquire the ability to perform the larger tasks of administration. Egypt does not call for our sympathy today; she is being treated reasonably well, having regard to complicated conditions, as I have outlined them. At Port Said, Ismailia, Cairo, and Alexandria I saw what we would call a building boom, a great activity in the erection of homes, many of them of beautiful stone and in a style that we might envy. On inquiry one is told that this one is built on cotton, that one on cigarettes, and another on sugar. Egypt is highly prosperous, but restless, not by reason of misgovernment or tyranny, but because the people have drunk the heady wine of self-determination, a political beverage (to vary the simile) that was meant by Woodrow Wilson for the smaller peoples of Europe—the Czechs, Poles, and Slovaks—not for the seething masses of awakening heathendom. These, having seen the European peoples killing each other, and having obtained a smattering of education, including the half-baked ideas concerning liberty that Europe has developed, are now in a ferment of unrest, presenting a task before which modern statesmanship appears to be shrinking in obvious ineptitude. The granting of political rights to a people, I venture to say, should be contingent upon their ability to exercise those rights intelligently.

A village on the outskirts of Zanzibar

On June 19 my two companions arrived at Alexandria from Cairo and we embarked on the Lloyd-Trestino steamer "Vienna" on our way to Venice. Next morning we found ourselves in the blue waters that wash the Cretan strand, and late in the afternoon we were off the isles of Greece. At 2:30 p.m. we reached the Italian mainland at Brindisi, where we went ashore for half an hour. The air was cool and pleasant; the "Vienna" proved first-class in every respect, and the food was excellent, especially the Egyptian strawberries and peppers *à la Grecque*. A band discoursed real music, not barbaric jazz. Our ship's company was well mixed, including Jews of many nationalities, Egyptians of Turkish and Arab blood, Germans, Italians, French, Greek priests, a British general, and at least two Cornishmen! Next morning we passed along the Dalmatian coast and at 2:30 in the afternoon we sighted Venice, in the midst of a heavy shower, which cleared the air and gave unusual radiance to the Queen of the Adriatic.

Our ship proceeded slowly down the Guidecca canal, permitting a view to the right of the Campanile of St. Mark, the clock-tower opposite, the piazza and its palaces, and beyond them the domes of Santa Maria della Salute; on the left was the Lido Island, with its handsome villas, an Italian Newport. We moored in the Guidecca canal, and at 4:30 p.m. a launch took us to the railroad station. There are many ways of proceeding to a railroad terminus, but none could compare with this Venetian transference. Rain fell heavily as we started, so that the score of passengers had to crowd into a small cabin under a leaking roof, but, fortunately, the storm did not last long, and the windows could be opened so that we did not miss the architectural panorama of the Grand Canal, down which we proceeded to the depot. We went under the Rialto bridge, and caught glimpses of lovely gardens, arched canals, and historic palaces. What a change from Central Africa! After our baggage had been checked, two of us went for a stroll as

far as the Ponte di Cannaregis, which is an arch, with steps, across a small canal. We lingered there, watching the people pass. Of pleasant look they were, many fair in complexion, and with an awakened intelligence. And these forsooth were the people that by legislative enactment we had pronounced undesirable as immigrants into our country! To me they seemed vastly more interesting than the crowd one sees disembarking from one of our trans-Bay (San Francisco) ferries. The train for Paris left at 6 p.m.

During the evening we passed through a lovely country, the great plain of Lombardy. Vines festooned the trees and were trained on poles to mark the boundaries between fields. Intensive cultivation was to be noted everywhere. A sunset of pearly tints and an opalescent perspective gave the proper setting for such a picture. Between Padua and Verona, more particularly, a succession of lovely landscapes, orderly, old, finished, civilized, provoked a vivid contrast with the parts of the world in which we had but lately lingered. Just before dark we saw the waters of Garda, glistening in the moonlight under dark mountains. I sensed the subtle odors of an old and immemorial civilization, and rejoiced to be again among people of my own kind. We slept well, awaking at 6:30 to see the town and lake of Lausanne. The Swiss hills were lovely; the fields looked well ordered, the forests were well kept, and together they made a charming succession of pictures. At 8 p. m. we reached the French frontier at Vallorbo, where a restaurant car was attached and breakfast was served. The train took us through the Jura into the Cote D'Or, the country of burgundies. The limestone hills and the careful cultivation, the orderly farm houses and clean-looking towns gave us a proper impression of France, the chief exponent of European civilization. We reached Paris in the afternoon of June 23. There our joint journey ended, for, after three days of excellent comradeship, Mr. George Kingdon sailed from Cherbourg for home, I crossed the Channel to England, and Mr. James Douglas remained in Paris.

On arrival at Berkeley, on July 21, I found that I had been absent five and a half months, and that I had traveled 32,000 miles. If there is to be any moral to my story, I would say that the experience of such journeys across the world suggests that community of education, and what is called good breeding, is more than community of race. It is the exaggerated provincialism that we call nationalism which does most to prevent a friendly understanding between the peoples of the earth.

Algeria an Important Source of Iron Ore

THE IRON-ORE DEPOSITS of Algeria are for the greater part of metasomatic origin, and are generally found in liassic limestone, according to a New York ore importer, in *Iron Age*. In this formation occur some of the best-known mines of the country, such as the Timezrit, Zaccar, Beni Saf, and Rar-el-Maden mines. Small deposits of magnetic ores have been found and operated, but they are relatively of little importance. The larger iron-ore deposits consist of red and brown hematites of good structure, low in silica, easily smelted, and in some cases almost self-fluxing. A characteristic feature of these ores is a convenient percentage of manganese. The principal mines are near the coast, with adequate shipping facilities.

The largest and most important iron mine on the north coast is the Ouenza, operated by the Société de l'Ouenza, a French company. Although organized in 1913, the company did not begin mining until 1921, the delay being caused primarily by the World War. Operations once started, production increased yearly until an output of about 700,000 tons was reached in 1925. It is estimated that more than 1,000,000 tons will be shipped in 1926. Ore reserves are reported to be large. The Ouenza ore, known as Ouenza-Companil, is a red hematite of good structure and mechanical condition and is almost self-fluxing.

The Ouenza company is interested in another mine also, the Bou Kadra, in the same district and about 12 miles from the Ouenza mine. Work at the Bou Kadra was recently started, and it is expected to be in operation by 1929. It is being equipped for an annual production of 500,000 tons of the same quality ore as that of the Ouenza mine.

Output of the Timezrit mines, near El Maten, is 100,000 to 150,000 tons per year, of a lumpy, non-phosphoric hematite, which has been used in the production of low-phosphorus pig iron both in Europe and in the United States. Mines of the Yebel Zaccar, near Milianah, in the Department of Algiers, produce an ore, which is a non-phosphoric, lumpy, soft hematite. Annual output ranges from 250,000 to 300,000 tons.

Near the Moroccan frontier there is a small deposit of manganiferous iron ore, known as Rar-el-Maden. Its production is small, only 50,000 to 60,000 tons annually, but it is of excellent quality. The Rar-el-Maden is a manganiferous iron ore of 6 to 8 per cent contained manganese, low in phosphorus and silica and of good mechanical condition. Another important deposit, not yet, however, being operated, is the Sidi Marouf mine. Present plans indicate the beginning of operations within the next few years. This property is near Constantine.

Analysis of Some Algerian Iron Ores

	Fe	Mn	SiO_2	P	S	Cu
Ouenza-Companil	56.19	1.90	1.67	0.006	0.085	0.05
Timezrit	58.50	1.10	3.80	0.014	.....	....
Zaccar	54.95	1.25	5.07	0.018	.....	....
Rar-el-Maden	51.10	5.75	2.97	0.015	0.204	....

Exports of Iron Ore from Algeria

Year	Tons	Year	Tons
1914	1,070,977	1919	770,224
1915	786,278	1920	1,096,527
1916	883,644	1923	1,448,000
1917	1,017,954	1924	1,815,000
1918	747,015	1925	1,660,000

The accompanying table of Algerian iron ore exports from 1914 to 1925 serves to indicate the rapid growth of the iron ore mining industry of the country. During the past ten years exports have increased 50 per cent—an average yearly increase of 5 per cent. Improvements now under construction or to begin shortly, soon should result in much greater production.

Of importance in the future development of Algeria as an iron-ore producing country is the improvement of transportation facilities from the mines to ports. Though much railroad has been constructed, the greatest advance is expected during the next few years. Port conditions are satisfactory at present and improvements are under way to permit handling the larger tonnages expected as the industry develops.

Mining Research

A Problem in Oil-Shale Extraction

By T. M. Bains
Associate Professor of Mining, Colorado School of Mines, Golden, Colo.

IN THESE DAYS of engineering research by colleges of engineering and by industrial-research laboratories, the question often arises as to mining problems outside those of a purely mechanical or electrical nature. We see the Ilgner system, with the Ward-Leonard control, applied to hoisting; the Ward-Leonard control to electric shovels; the caterpillar tread to power shovels; synchronous and super-synchronous motors to constant-speed loads, with great improvement in the power factor of the system; static condensers in connection with alternating-current coal-cutting machines; electric signal systems for mines; and a multitude of other applications of mechanical and electrical engineering to mining problems.

The advance in mining technique, such as improved methods of stoping, reducing the cost of production, has been due principally to the interchange of ideas in the mining industry. Utilization of ideas developed in one branch of the industry by another branch has often revolutionized the methods used in the latter. The idea of hoisting water automatically in bailers, which was developed by the anthracite industry, has been applied to the automatic hoisting of ore in skips; power shovels were used underground, following their success on the surface; shrinkage stoping of limestone and other rock products was patterned after the shrinkage-stope methods of the metal miner; and the latest example of such utilization of methods used in one branch of the industry by another is the coyote-hole caving method of mining of the Alaska Juneau. By the application of the coyote or tunnel method of quarrying to underground mining, the tons of rock broken per pound of powder has been increased to 18 tons per pound, a remarkable figure when one considers that in mammoth blasts in quarries a third of this tonnage is seldom obtained.

Analyzing the Problem

In attempting to solve a mining-research problem, the following divisions of the topic are advisable:

A. Statement of problem.
B. Basic principles involved.
C. Investigation of all known methods or processes, which might be applied to problem.
D. Investigation of new methods or processes.
E. Commercial aspect. Will the best method or process produce a profit under known commercial conditions?

Accordingly, the method of attacking the problem of mining Colorado oil shale would be as follows:

A. Statement of problem.

The problem assumed is that of mining a deposit of oil shale, such as is described in the *Engineering and Mining Journal-Press* of Aug. 22, 1925, on page 299. Geological conditions are summarized thus: 350 ft. of overburden, consisting of alternating beds of sandstones and low-grade oil shale; 350 ft. of 14-gal. per ton shale; 50 ft. of 36-gal. shale; 34 ft. of 16-gal. shale. The shale dips at low and uniform angles. Drainage is favorable for tunnel development. The character of the shale beds is that they are mostly of "paper" shale, abrasive when fresh and difficult to crush and break fine when mined. As to climate, there are moderate rains and snows in winter.

B. Basic principles involved.

a. Basic principles underlying the successful working by open-cut, by glory-hole, and by underground methods.

b. Principles of breaking and crushing by explosives and mechanical appliances.

c. Principles involving the combustibility and explosibility of oil shale and shale dust.

d. Principles underlying the production by the mine of a uniform grade of product, from various strata containing different amounts of oil per ton.

C. Investigation of all known methods which might be applied to problem.

a. General rules applied to open-cut underground mining:

In coal mining by stripping; 3 ft. of overburden, of which 60 per cent may be rock, may be stripped for each foot of coal uncovered; or another rule is that three tons of overburden may be removed per ton of coal. But these rules are for a comparatively small depth of overburden.

On the iron ranges, the rules are 1 cu.yd. of stripping per ton of ore; or 2 ft. of depth for 1 ft. of ore (hard rock being considered from two to three times that of soft material, or 1 ft. or two-thirds of a foot of stripping per ton of ore); with an economic stripping depth of 150 ft.

In the problem at hand, there is 350 ft. of stripping, a depth that would be prohibitive under the above rules of the iron ranges, limiting the depth of stripping. There is also the problem of working in a shale deposit in wet weather. There is no doubt that the crushing and retorting problems would be greatly increased if the shale were mined by open-cut methods in a climate like that of Colorado.

There are also the problems of transportation from the open-pit workings to the retort plant, which in many cases would have to be by aërial tramway, or else through a transfer raise from a tunnel near the bottom of the formation.

The glory hole in large open-pit operations is a transition step between the open-pit and underground mining stages. It has been successful at Fresnillo, Mexico, owing to climatic conditions. In Colorado, there will be a number of physical conditions that will interfere with low-cost operation. The paper shale weathers badly, and the working conditions during winter and rainy spells would be poor. Also, the objection to wet shale for the retort plant would hold, as for open-pit mining in wet weather.

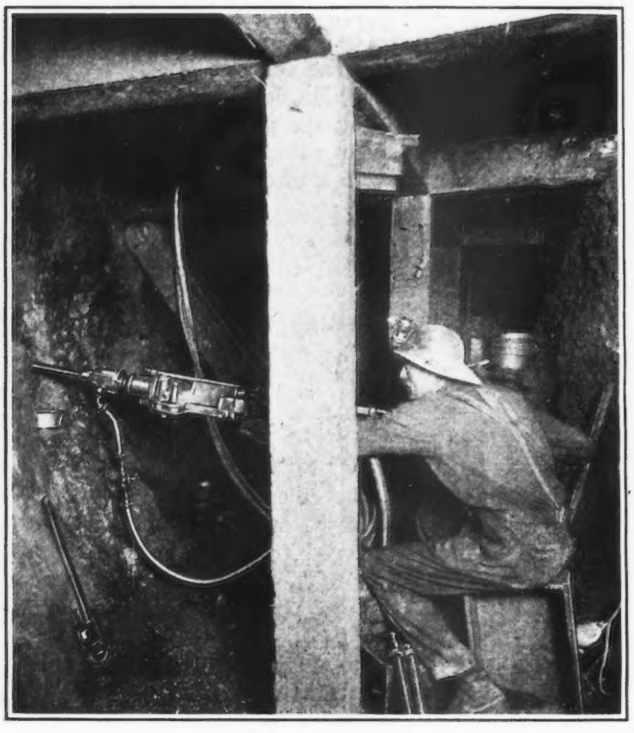
Should a low-cost underground system of mining be

developed, its advantages would recommend its selection in preference to open-pit or glory-hole methods, save for the problem of mine fires.

Coal-Mining Methods Not Cheap

b. General rules for breaking rock underground:

Coal-mining methods, such as the room-and-pillar method, the longwall method, and variations of them, are not cheap. Without a doubt, the cost of mining by any of these methods cannot be expected to be less than the cost of mining coal by the same method. The abrasive nature of most oil shale *in situ* is such that any coal-cutting machine would be subject to a high maintenance and repair charge. The toughness of oil shale also would increase the explosive charge. There is no low-cost method of working a thick seam of coal, and these methods do not need to be considered when there are methods of the Alaska-Juneau type, which are at present feasible.



One-man deep-hole machine drilling a 64-ft. prospect hole in the Chief Consolidated mine, Eureka, Utah. Such horizontal holes might be used in a method of mining oil shale

Methods of mining thin veins may be discarded, because of excessive costs. No method of mining wide veins, using timber for support, is feasible, not only because of high costs, but because of danger of mine fires. Open-stope methods, with pillar support, such as are used in the southeastern Missouri lead district, do not give low enough costs. Costs of loading, breaking, and tramming alone amount to around 70c. per ton, and with the overhead charges against them the cost would be around a dollar a ton.

Methods of mining shale for the clay industry by means of the "shale planer," a product of the Eagle Iron Works, Des Moines, Iowa, might be practical in certain open-cut projects, but cheap underground mining by such methods seems out of the question at present.

The vertical and horizontal cut-and-fill methods are not to be considered, owing to the cost of filling and because the introduction of timber would increase the fire hazard.

The method of shrinkage stoping used at present generally calls for square sets to mine the pillars between shrinkage stopes. It is seldom that the width of a shrinkage stope can exceed 60 ft. with safety. In inclined deposits, such as the limestone formation at Bellefonte, Pa., cheap mining is possible. The American Lime & Stone Co. there finds that in some cases underground mining is cheaper than open-pit work. But in the flat deposits of Colorado shale this would not be true.

A Caving Method Possible

This leaves the caving methods to be considered. Of all the systems under this head, the Alaska-Juneau method, as described in the *Transactions* of the American Institute of Mining Engineers, Vol. 72, seems to give the lowest cost of mining by a method of coyote-hole or powder drift caving. The cost is 22.67c. per ton, with an explosive factor of 18 tons broken per pound of powder. This is remarkable, as the explosive factor is three times better than in mammoth quarry blasting operations. However, the bulldozing costs are around 10c. per ton, showing that large blocks of rock are broken in the stope by this method.

At the present time it would therefore appear that this method of the Alaska Juneau might be the one best adapted to breaking oil shale. However, there are several points to be carefully considered in connection with it. The first is the problem of the combustibility of oil shale from large blasts with standard explosives; the second is the danger, in the case of bedded deposits of a tough material like shale, of having immense blocks of shale drop into the stope practically unbroken; third, the danger of dust explosions in the passageways, after a blast; and fourth, the irregular assay value of the material drawn from the chutes.

With temperatures around 5,400 deg. F. at the point of explosion, a special "permissible" explosive will be required to prevent igniting of rich shale. Some shale will catch fire from a match and burn readily. By the use of Cordeau-Bickford fuse, the danger of ignition from burning fuse is eliminated, but research would have to be made into the subject of explosives for this work.

Applying New Methods

D. Investigation of new methods which might be applied.

a. New methods of breaking ground and mechanical appliances:

The Alaska-Juneau method of coyote-hole caving was developed from the practice in quarry mining. In quarrying, there are three principal methods of blasting used by the crushed-stone industry, namely:

1. Drilling of comparatively small-diameter holes with air drills, and the chambering or springing of these holes by successive charges of explosives in the bottom.

2. Use of coyote holes or tunnels into the face and right-angle crosscuts, with heavy charges of explosives in the ends of the crosscuts.

3. Drilling of large-diameter holes with the standard

well-drill rig, like the Keystone; or drilling holes in soft formations with the earth-auger.

The first method is generally used in connection with the third. At the Utah Copper mine, the top holes are drilled with oil-well rigs, and the toe holes and face or bench holes with air drills.

The second method has no advantage generally in lower costs of blasting, but is often used in mountainous places where drilling can be done by hand, thus eliminating the installation of expensive compressed-air machinery, or where well rigs cannot be brought in, on account of the condition of the roads. But, generally, as far as the breaking of the rock is concerned, in both cost and size of pieces, the well-drill holes system has the advantage.

This gives a new line of attack on the problem. Consider the Alaska-Juneau practice with horizontal holes, or holes of any desirable inclination or angle; holes of large diameter, similar to those used in the third method of quarry blasting. Instead of vertical holes, inclined or horizontal holes will be used to facilitate caving after the ore chutes have been funneled out beneath.

From quarry costs and comparison of costs by the deep-hole prospecting method, as described by Charles A. Dobbel, in his article in the *Transactions* of the A.I.M.E., Vol. 72, page 677, and from my own experience, deep-hole drilling and blasting in connection with a shrinkage-caving system is practical and can be practiced at the same cost per ton as the Alaska-Juneau method. But there are some research problems to be attacked which can be done with little expense and by mining schools and research laboratories.

The following problems arise from the consideration of a mining method using shrinkage-caving with deep-hole blasting:

1. Design of auger bits to be used with the standard "deep-hole" air machines, like the Denver rock drill No. 34.

2. Design of an electric drill for deep-hole augering, and the comparison of the operating costs of this machine with the compressed-air machine; electric-driven channelers or drilling machines take only about one-fourth the power for the same work as do compressed-air machines.

3. Heat treatment of auger bits, with special attention to the "wet" type, which will have to be developed under (1).

4. Heat treatment of the auger rods and water-jacketed shanks, which at the present time in deep-hole prospecting are giving considerable trouble. This in one case, to my personal knowledge, is increasing the cost per foot drilled by at least 50 per cent.

5. Method and apparatus for charging these deep holes, which are nearly horizontal or inclined upward, with black powder, dynamite, or liquid explosive.

6. Balancing of rods in deep-hole drilling, if weight is excessive.

7. Investigation into permissible explosives for this work.

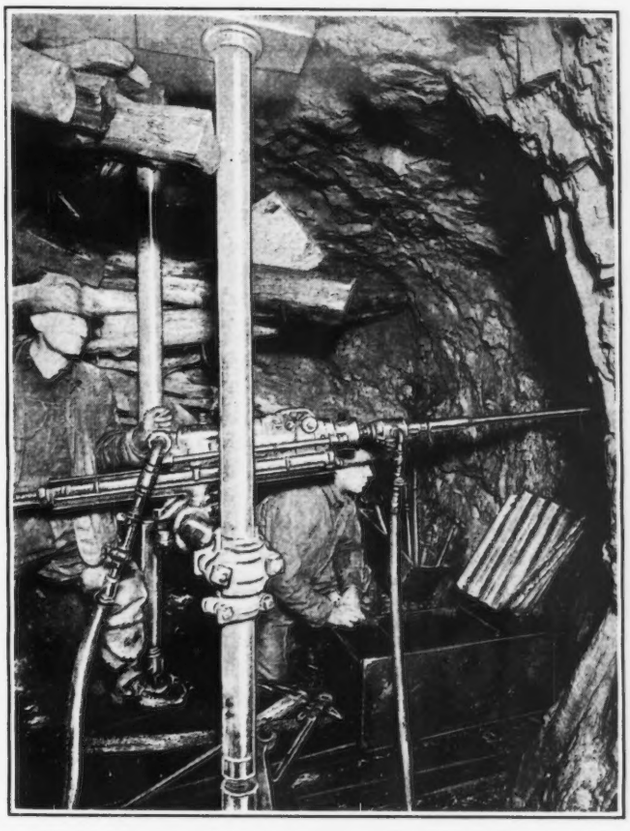
8. Investigation into the possibility of using a hydraulic drill for augering, similar to the Brandt type used in some of the railway tunnels through the Alps.

9. Design of a simple device to register the deflection of a deep hole from its true straight line, so that the hole may be plotted before charging with explosive and the burden determined.

What the Auger Can Do

In connection with the above research problems the following may be of interest:

1. If an auger bit is made of the proper steel and is properly heat-treated, it will cut any oil shale. This is based on the fact that hand augers are used to drill holes in fairly hard augite-porphyry in the oxidized zone. Most mining companies are not familiar with the possibilities of the auger. Such speeds as 17,000 ft. of hole in iron ore, by two miners, per month, make one realize that high speeds are obtainable if conditions are right.



Drilling nearly horizontal deep holes

The question of the best steel for auger bits has never been thoroughly investigated. I have myself used hand augers in oxidized augite-porphyry, which was moderately soft drilling ground for hammer work, and have driven a tunnel 300 ft. with them. The auger that gave the best service was made from an old file, picked up on an old mine dump on the Mother Lode of California and probably thirty years or more old. It was therefore made of Swedish steel, very pure, and had a high carbon content. The other augers on hand were made from either wagon springs of fairly low-carbon steel or else of American-made files, of quality inferior to that of the first one mentioned. I drove over 2,000 ft. of hole with the first auger, and in other work in a shaft 1,200 ft. That auger had therefore done over 3,000 ft. of boring. On coming to the Missouri School of Mines, I cut off the end of this auger and sent it to the Bureau of Mines at Minneapolis. There they

Co., by keeping a monthly balance sheet, drawing certain tonnages from stopes having various types of ores. The mill at Nacozari was built for a 3.1 per cent copper feed. The mine at Pilares ships practically this product, by producing a certain tonnage from specified stopes. As the assay value of the ore in these stopes may vary from around 2 per cent copper to 30 per cent or more, the method has been practically perfected by that organization.

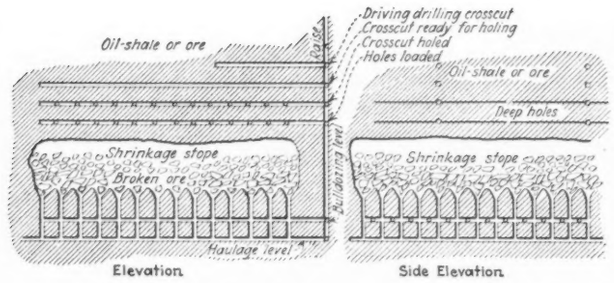
Oil-shale beds will vary in assay value, as stated in the problem, so it may be necessary to mine certain tonnages per day from the lower beds, while tonnages are being mined from upper beds. This may result in a system of mining where the practice of "shrinkage-caving" will not be suitable to the thinness of the beds. That is, there may be stopes in which a bed only 40 or 50 ft. thick will be mined, while some other stope will have a back of hundreds of feet.

A method of mining with inclined uppers, using deep-hole machines, could be worked out, so that no men work under the roof of the stope. Such a method would be a "longwall-shrinkage" method, as the shale would be drawn from the stope just as the ore is drawn from shrinkage stopes, but ore would be left up to the roof or back of the stope to support the excavation until the final breaking of shale in the stope could be finished. Then the whole stope filled with broken shale could be drawn. The roof of a tough flexible shale would rest on the broken shale in the stope, preventing large blocks dropping from roof, which would happen if the shale were drawn too soon. The mechanical appliances would be the same as for the first-mentioned shrinkage-caving, and the holes would be drilled upward at a steep angle from a mining floor at the top of the ore chutes, and men and machines would always be under the protection of roofs of narrow drifts or crosscuts. The loading of these deep holes would be the principal problem, not drilling of the holes or the mining method.

The above method of attack may be used in other mining problems in the rock-products industry, and in mining of large low-grade ore deposits. The reason for bringing this matter to the attention of the mining profession is that questions are so often asked as to the possibilities of mining research, and the answer is returned that there are few if any problems that can be worked out in mining schools or research laboratories. A number of the problems presented in the foregoing could be worked out on a small scale in our colleges; but such problems as that of the danger of fire in the stopes from heavy charges of explosives could be solved only by drilling a deep hole in a rich shale bed and charging it with a heavy charge of black powder or low-grade dynamite and seeing if there were any part of the broken mass ignited.

Should there be no danger of fire in stopes, there seems to be little doubt that, as far as mining goes, the oil-shale deposits may be worked at costs below 60c. per ton, this cost to include all overhead, with amortization, depreciation, insurances, and taxes. The retort problems and the question of the disposal of spent shale from the retorts are much more serious than those connected with the mining.

On the road to Mina Ragara, Peru



Sketch showing the shrinkage-caving method with deep-hole blasting, intended for mining a deposit of great thickness

analyzed the steel and found it a very pure 1.2 per cent carbon steel. The structure resembled the famous Damascus steel, in that it was formed of spherulitic cementite, with radial structure, in troostite. In this it resembles Damascus steel, except that the latter is 1.5 per cent carbon. The purity of the high-carbon steel and the heat-treatment that I always gave it on sharpening it was the reason for its superiority over the other augers.

2. It seems reasonable to expect that an electric or an electric-pneumatic drill will be developed for boring with augers, that will be superior to the present type of compressed-air drill for this work.

3. The heat-treatment problems have been mentioned under (1).

4. The subject of the heat-treatment of the rods and water-jacketed shank needs more attention, even in the present deep-hole prospecting outfit. I spent all last summer on this work, and although the cost of drilling was under a dollar per foot, at least 50 per cent reduction in cost could have been made if the rods and shanks had been properly heat-treated. The threaded ends of the rods were forged at a yellow heat and thrown on the ground to cool, and then turned in a lathe; with the result that often in a 100-ft. hole, the threaded end would break before the hammer blow was struck at all. In other words, while running the bit to the bottom the threaded end would break off, sometimes in two fractures an inch or so apart. Very little breakage occurred except at the threads. Any metallographist could have given the reason for this breakage.

The Problem of Loading Deep and Almost Flat Holes

5. Again we have a new problem in charging nearly horizontal deep holes. With dry powder, some method of blowing it in may be devised, but with dynamite a charging machine must be designed to operate in a small tunnel, and must not injure the Cordeau-Bickford fuse, which must extend to the bottom of the hole, or the electric wires of electric detonators.

A liquid explosive may be invented to be forced into these nearly horizontal or "upper" holes, by plugging the collar of hole. There is wide field for research in this problem alone.

6. At present, there are "balancing" devices used on the deep-hole prospecting machines, when the weight of the rods become excessive. On electric-driven auger drills this will have to be considered especially.

7. While investigating a liquid explosive, the question of its permissibility in oil shale will have to be considered. The so-called permissible explosives for coal mining are "permissible" only under certain conditions. Most states have laws requiring the charge of permissible explosive to be less than a certain amount, generally around a pound and a half of explosive per hole. With black powder, some means may have to be worked out to assure that the temperature and flaming qualities are cut down in mammoth blasts. Gelatin dynamite in water may solve the problem for dynamites.

8. The Brandt drill is an auger drill for hard rock, and therefore may find a field in shale drilling. It can drill a 4-in. hole without trouble. The high-pressure water system would be the disadvantage most objectionable.

9. As a deep-hole prospecting drill generally works best on flat uppers, the holes would probably be started on a 10- or 15-deg. inclination. But it is found that, at this angle, there is about 10 per cent deflection from the true line. In other words, after drilling 100 ft. at this inclination, the hole is 10 ft. below where it should have been if there had been no deflection. A measuring device, readily used by any engineer, can easily be designed. A folding metal measure, in 5-ft. lengths, with scales at the joints, showing deflections of the hole at each horizontal section, could be made to record such deflections in both the horizontal and vertical planes. Before charging the holes, an accurate plat of the bottom of the holes would be advisable. For deep diamond-drill holes, many devices have been invented, but these are too complicated and expensive.

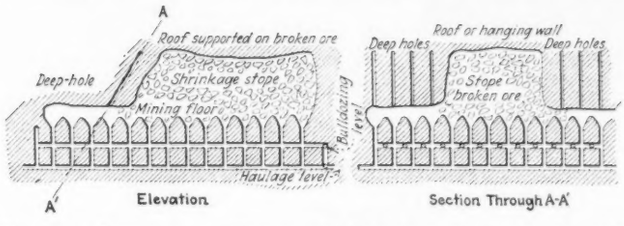
The Fire Risk Involved

a. Combustibility and explosibility of oil shale:

Little has been done in studying this matter, although the Bureau of Mines at Pittsburgh has tested one sample of shale dust in its explosibility chamber. However, there seems to be a field for further research, as any substance that will ignite from the flame of a match may easily present some problems in case of large stopes filled with it, should they catch fire. As to the explosibility of oil-shale dust, the rules laid down by the Bureau of Mines for rock-dusting coal mines may not be safe with oil-shale dust. A substance composed of 60 per cent of shale or inert dust mixed with coal dust in most cases makes a mixture not exploded by permissible explosive charges.

b. Production of uniform grade of product for retort:

In all metallurgical plants, it is advisable to get uniform feed, and this is done by "bedding" or other similar method, using the traveling belt-conveyor machine of standard type. If the mine can ship a daily uniform grade of product, however, the problem at the retorts is simplified. This problem has been solved by some copper companies, such as the Moctezuma Copper



Sketch showing a "longwall-shrinkage" method with deep-hole blasting, intended for mining a deposit of considerable thickness. This method can be followed by the shrinkage-caving method, if the roof is low-grade ore

(page 749, Vol. 2, Descriptive Geology, U. S. Geological Exploration of the Fortieth Parallel) that the Indians about the Soda Lake, near Fallon, Nev., prepared a special dish of that character. His statement is as follows:

"The waters appear to be wanting in animal life, with the exception of a minute fly, the larva of which is a small worm, accumulating in such large quantities as to form a belt a foot wide along the shore. It is occasionally gathered by the Pah-Ute Indians, and, after drying and pulverizing, made into a sort of meal or flour. In the autumn, when the water becomes somewhat dense, the larva are completely coated with carbonate of lime, and transformed into an irregular mass of mineralized matter."

I fancy that I can see that human being hustling for all he was worth, while the season was on, to get in a quantity of this edible delicacy, before autumn came on and removed the possibility of adding to his store, for his winter needs. The supply may have become so depleted by other epicureans who were at the soda lake in advance of him that he was obliged to overreach himself, lost his balance, and passed into oblivion; possibly, too, he may have previously partaken too heartily of the dish, which handicapped him in his efforts to reach terra firma. JOHN T. REID.

Lovelock, Nev.

Oxygenated Air in Metallurgy

THE EDITOR:

Sir—On page 613 of your issue of April 10, 1926, to an inquirer who asks you "If any work has recently been done concerning the application of oxygen-enriched air in metallurgy?" you reply practically in the negative.

It may interest not only that inquirer but many other metallurgical engineers to know that the subject was touched on in a note by Professor Briggs in *Colliery Engineering* of March, 1926. Like your inquirer, I at once tried to follow the gleam through an English technical periodical, but only landed in darkness similar to yours. They could give me no further information.

Professor Briggs' article, however, carries us a step further forward by showing that some beneficial results have actually been obtained in practice by Professor Mazza, of Turin, using enrichment by centrifugal differentiation, in spite of the chorus of croakers who said that either it couldn't be done or that it wouldn't be worth doing, much as the theoretical wiseacres prophesied of aërial flight before it was done.

True, it is not a high percentage of enrichment that has been attained so far. But even such as has been accomplished at the cost of a little extra power would be welcomed by many a smelterman for his blast furnace or converters. It might just suffice to turn the balance from failure to success or give increased capacity and output without extension of plant. Moreover, it is not likely that Professor Mazza has reached at once perfection of design and construction in his centrifugal enricher. Such progress generally takes time and experience. But if he has found its application profitable just for burning poor coal, it should certainly encourage others to try it where the advantages may be expected to be greater. The original patents dated 1899 and 1902 must have expired; so the field should be open to the proper combination of brains and capital without waiting for oxygen at $3 per ton.

As high-speed turbo-blowers are now not uncommon in smelter equipment, it would seem to require no great stretch of the imagination to see them modified into a kind of glorified cream separator, but whose function would be to throw away some of the skimmed milk and thereby enrich the remainder of the working fluid.

S. SEVERIN SÖRENSEN.

Care Messrs. Yeatman & Berry,
165 Broadway, New York.

A part of Professor Briggs' article mentioned by Mr. Sörensen follows:

METHOD OF OPERATION

"On both the scientific and technical sides the Mazza process of centrifuging air is of much interest. By passing air into the center of a rotary separating drum or turbine provided with vanes and rotating at a high speed, air with a higher oxygen content can be drawn off from a stationary casing surrounding the drum, while air with a reduced oxygen percentage is discharged through the hollow shaft of the machine. The densities of oxygen and nitrogen are not very different, being in the ratio 8 to 7, but Mazza finds the difference sufficient to enable a partial separation to be effected in this way.

"One of the principal difficulties of centrifuging a gaseous mixture is that of the high velocities required to obtain appreciable success. As the driving power of the machine varies as the square of the speed of rotation, an increase in speed involves a much larger increase in the power consumption, and questions of economy impose a limit upon the speed. There is, again, the fact that the gas in the rotating drum undergoes compression toward the periphery, and compression seemingly retards the outward passage of the oxygen molecules. The inventor claims to have overcome these difficulties and to have devised a machine capable of treating large volumes of air with simplicity and efficiency, and requiring a minimum of trained supervision. Those interested in the details of the process could with advantage consult Mazza's British patents of 1899 and 1902.

PRACTICAL APPLICATIONS

"In the tests in which centrifugal action has so far been applied, the degree of enrichment of the air is small. In the present case it amounts to 15 per cent, which is equivalent to an increase in the oxygen percentage (by volume) of from 21 to about 24 at a cost of 2 per cent of the power generated by the boiler. Percentage enrichment being also proportional to the square of the velocity, super-oxygenation varies directly as the power consumed, and high enrichment becomes expensive. From a practical point of view, an enrichment of about 30 per cent (oxygen-content, 27 per cent) appears to be about the maximum procurable, and such a result is obtained with turbine blades 14½ in. diameter revolving at a peripheral speed of 400 ft. per second.

"The Mazza process cannot compete, and is not intended to compete, with the various liquefaction processes of producing oxygen of high purity; but it is much cheaper than the latter when large volumes of slightly enriched air are required.

"At the present rate of exchange, the cost of the centrifuging plant at Savona is stated to have been about £450, but Prof. Mazza tells me that he is making two other machines, each costing under £200, which are to be installed in connection with a coal-fired boiler generating 3,000 hp. and an oil-fired boiler generating 6,000 hp., respectively.

"The Mazza process has had several applications outside Italy, though, so far as I am aware, not in conjunction with steam-raising. The first of these was at Ougrée, Belgium, where the late Dr. Peters built a small blast furnace and operated it for several years with enriched air. During the latter part of the experiments, and just before the war, the oxygenated air was obtained from a Mazza machine having blades 12.8 in. diameter. The delivery was about 1,200 cu.ft. per minute of air containing 23 per cent of oxygen. The death of Dr. Peters cut short trials which had much metallurgical interest, and apparently nothing was published regarding them. Just after the war, Mazza installed plants in the United States, one of which yielded nearly 3,000 cu.ft. of slightly enriched air per minute for a power expenditure of 12 hp."

Discussion

Patent Litigation

THE EDITOR:

Sir—The balanced moderation of Mr. Greenawalt's able letter in your issue of May 8 compels attention and co-operation. The efficient protection afforded to other forms of property seems notoriously at fault in the matter of patents. Here we are faced with the medieval attitude of might being right and ownership a question of fighting prowess. All very fit, doubtless, for the survival of the fittest and for evolution in the dark ages, but scarcely flattering to twentieth-century civilization.

On the other hand, Mr. Greenawalt must not forget that the action of certain American groups, who in the earliest stages offered what was then considered fair payment for both the Pierce-Smith and Minerals Separation royalties, is evidence of a higher standard of morality than that which obtained in the introduction of the cyanide process, for instance.

The first patent actions ever raised in certain territories, for example, Cape Colony, Transvaal, New Zealand, were raised by me to protect the rights of the owners of the cyanide process. On the Rand, however, the presence on the bench of a doctor of divinity, who had previously expressed his firm objection on principle to all patents, was effective in canceling the patents. Now it is universally admitted the successful introduction of the cyanide process was directly responsible for the building up of the Rand gold fields into the premier position in the world.

It is obvious that a new and successful process does not arise without expense, thought, anxiety, and fostering care. Even if the verdict of that isolated local court had been just, that in no way absolved the mines from the moral obligation to recompense the introducer of the work of which they so freely availed themselves. Can the mines be surprised if, later, labor uses this argument to claim a greater share of wealth unjustly appropriated?

To take a case nearer home: The most successful contribution to the treatment of slimed ore is Brown's air-lift agitator, otherwise known as the pachuca tank. The use of this has now spread over five continents. In your recent reference to the new Anaconda zinc plant at Great Falls it appeared that the use of these appliances had even spread from the metallurgy of gold and silver to that of zinc. Has Brown ever been sensibly remunerated for his world-wide successful effort?

In the technical literature to hand in this mail is a description of a differential-flotation plant. In that description reference is made to the use of a modified Komata liner—also invented by Brown and widely adopted. I am led to wonder if this useful Mr. Brown is living in luxury on the proceeds of his widely used inventions or is eking out an existence on the hard earned savings of his other life work. We need more letters such as those of Mr. Greenawalt. We have to arouse the consciences of the industry to the fact that it is as mean to steal a man's work as it is to steal his purse. If individuals are loath to pay the inventor, the government should make infringement far more costly and painful. At present an effective deterrent scarcely exists. Who can afford to pay the cost of the lawsuits of the Minerals Separation company; and yet the ethics of the case are simple. If a man does not wish to pay my price, let him be content to go on as before without attempting to filch my work.

One point stands out: Cyanidation as a process effective in operation was initiated at Johannesburg. Since that date we have not had from that district a single outstanding improvement in the metallurgy of gold. By outstanding I mean of such merit as to be generally adopted in the industry elsewhere. If the attitude of the Rand mine owners to cyanidation is not the cause of this remarkable situation the coincidence is extraordinary. The filtration of slime by Dehne presses or vacuum filters, the adoption of tube-milling, of air-lift agitation, of effective slime settlers, and now of sand classifiers has come from other fields. What single thing except the cyanide process have the other fields from Johannesburg?

I should like if possible to end this letter more constructively. I remember that when Brown applied for his patents in the Transvaal he was frightened off by the demand that he deposit a sum to cover the cost of the Chamber of Mines in opposing the patents. It would seem fairer if in future any infringer were compelled forthwith to deposit a sum to cover the cost to the patentee in defending rights granted to him by a government department already satisfied as to the legality of these rights based on adequate service to the industry.

ALFRED JAMES.

London, England.

The Fly in the Soda

THE EDITOR:

Sir—Your issue of May 29 contains a reference to the finding of human remains in a soda deposit 80 or 90 ft. beneath the surface, near Jerome, Ariz. One might arrive at the conclusion on reading this article that the remains in question would be very ancient. I am of the impression that such is not the case, reasoning that the man had been engaged in some mission in that section when this deposit was in liquid form; that is to say, when it was a former soda lake. Of course, if he found his last resting place in what was a former soda lake, naturally his body would be found at what was the bottom of the lake at that time.

The question of what this man may have been engaged in doing at the time he forfeited his life is one that it would be hard to answer. However, one may venture a guess. Perhaps he had a taste for larva porridge, as some of our old Piute Indians had before the advent of the white man. We are told by no less an authority than Clarence King, in his volume on Geology

News of the Week

The Mining News of ENGINEERING AND MINING JOURNAL-PRESS is obtained exclusively from its own staff and correspondents, both in the United States and in foreign fields. If, under exceptional conditions, material emanating from other sources is published, due acknowledgment and credit will be accorded.

Summary

OLIVER IRON MINING CO.'S crushing and screening plant largest in Minnesota; capacity about 15,000 tons per unit per ten-hour day.

Submarine tin mining proposed at Island of Banka—New nitrate prices announced—Lena Goldfields subject of derogatory propaganda from Paris.

Michigan College of Mines conducts experiments to utilize low-grade iron ore.

Reported gold rush at Quartz Mountain, Nevada; claims bring good prices.

Joplin production declines, awaiting higher prices for lead and zinc.

Penalty duty on pig iron may cause retaliation by foreign countries—Senate passes amended oil-leasing bill—Minnesota royalty tax upheld.

Tomboy mine (Colo.) not to be closed as reported—Old Dominion enlarges concentrator—Calumet & Arizona installs largest electric hoist in Bisbee district.

Results of development at Red Lake not yet made public—Mining interest in Michipicoten district being revived.

Calumet & Hecla unwaters No. 4 shaft—Seneca employs 325 men—Quincy mine developing new lode.

Transvaal April gold production shows increase of £1,000.

Railroad to Rouyn to Be Completed in September —Noranda Now Making Good Progress With Smelter Construction

By Our Special Correspondent for Northern Ontario

GOOD PROGRESS is being made with the construction of the Rouyn Railway, and it is understood that the contractors are about two weeks ahead of their schedule. It is expected that steel will be laid to the camp by about the first of September. The Horne Copper Corporation is letting contracts in connection with its smelter, the Canadian Bridge Co. having secured an order for 3,000 tons of structural steel. Work on the foundations has not yet been started, but the cement for this job was teamed into the property last winter. The foundations will be ready by the time the railway is completed and the structural materials begin to arrive. Noranda Mines, which owns 100 per cent of the Horne Copper Corporation, has organized a new company called the Plata Mines, Ltd., to operate the Hylands claims, in Gowganda, which Noranda Mines recently took over. A new shaft will be sunk on this property, but will not be started until August, as there will be some delay in obtaining electrical equipment.

Developments on Alderson-McKay Promising

Developments on the Alderson-McKay property, in the Rouyn district, show it to be of increasing importance. Three diamond-drill holes have now intersected the orebody. The first one showed a width of 14 ft., the second 25 ft., and the last a width of 56 ft. Though assays have not yet been received, it is believed that it will average about 6 per cent copper, but does not carry as high values in the precious metals as the Horne. The Alderson-McKay is looming up as one of the big discoveries of recent years, and in addition to the orebody mentioned above, it has several others which have been partly explored. Recently the Alderson-McKay Syndicate turned its holdings over to a company called the Towagmac Exploration Co., Ltd., the name being obtained from the first letter of the names of the members of the syndicate. The company owns a 35 per cent interest in the Alderson-McKay property, N. A. Timmins having the other 65 per cent. The company also owns 75 per cent in the Francouer-Bell-Thompson group and 35 per cent in the Lake Fortune Co., as well as other groups throughout the district. The new company has 1,000,000 shares of no par value, 700,000 shares being allotted to the original syndicate for the property and services; 75,000 shares have been offered at $1.50 per share, and subscriptions for 300,000 shares have been received.

It is reported that the Coniagas company, of Cobalt, Ontario, has made a copper discovery on its claims in Montbray and Duprat townships.

Other Activities

During May the Dome Mines, Porcupine, Ontario, milled 46,300 tons and recovered bullion to the value of $326,028. For the first five months of the present year, production amounted to $1,662,525, a decrease of $107,000 compared with the corresponding period of 1925. Indicated profits are a little over $800,000, so that net profits, making allowance for non-operating revenue, will be about $850,000, against dividend requirements of $953,334.

Production at the Vipond mine, in Porcupine, in May, amounted to $46,900 from 4,988 tons treated. It is expected that some time in July the new mill will be completed, which will permit of a daily tonnage of 300 tons and a monthly recovery of approximately $80,000. With this tonnage, costs should be about $6 a ton. Recent developments on the 2d, 6th, 7th, and 12th levels continue favorable.

The new mill of the Cobalt Contact Company, in Cobalt, is now running regularly. Good results are being obtained underground and high-grade mill ore is being mined on the 250 level. Drifting will soon be started on the 300 level of the Green-Meehan property adjoining the contact, which the company has under option. The ore carries a good deal of argentite and ruby silver, which necessitated the installation of a flotation unit.

Nipissing Mines, of Cobalt, has made a further payment on the claims adjoining the Canadian Lorrain property, in South Lorrain. Underground work continues satisfactory and will be pushed as rapidly as possible.

There is still no definite news of importance from either the Dome or the McIntyre operations in the Red Lake district. The Dome is continuing work with three drills and in addition has brought in about fifty men for surface work. To date twelve holes have been completed on this property, but assay results are not available. The company will not commit itself to any statement until it has more information.

On the McIntyre property, adjoining,

two drills have been running, but it has been decided to stop one drill and start a gang of men on surface trenching. The vein was not exposed on the surface of the McIntyre group as it was on the Dome, and the drills were getting ahead too fast. Though the absence of information might perhaps not be considered the best sign, it is understood that there is no reason for discouragement. All mining enterprises of this sort pass through uncertain stages in their preliminary development, and this appears to be the case at Red Lake. It is known that substantial assays as well as free gold have been obtained by the diamond drills, but the information obtained to date is not yet sufficiently conclusive to warrant a statement, either one way or the other.

REVIVAL OF MINING IN MICHIPICOTEN

The Michipicoten district, lying along the Algoma Central Railway, north of Sault Ste. Marie, Ont., is one of the older mining sections of this province which is now showing indications of some revival. It was the scene of some of the earliest gold discoveries, and twenty-five years ago Wawa City, the entrance to the district, had a population of about 2,000. In that district are the old Minto and Grace properties, the latter having been a producer. The Grace is now under option to J. A. Jacobs, of Montreal, and diamond drilling has been started some distance north of the shaft, in an effort to pick up the continuation of the vein. If this is successful a new shaft will be sunk. The Minto property is under option to the Pioneer Syndicate, a new company formed by the Keeley, Vipond, and Canadian Lorrain interests. The surface showing was very promising, and a number of years ago a shaft was sunk to a depth of 100 ft. This has been dewatered and an electric plant installed, and drifting is now being carried on at that level. Dewatering was started about May 1, but about 350 ft. of drifting has been done, and in the last thirteen days of May an advance of 227 ft. was made with two machines working two shifts. The vein has been proved by diamond drilling to a depth of 340 ft. vertically, which is over 500 ft. on the incline. The same company has the Cooper property, in the immediate vicinity, also under option and is diamond drilling this. Last year 2,400 acres were staked, and this ground is now being prospected by three separate parties. Altogether, the Pioneer Syndicate has 60 men working in the district between the Minto and Cooper prospecting operations. Some promising surface discoveries have been reported this spring.

LARGE IRON DEPOSITS AVAILABLE IN MICHIPICOTEN AREA

The Algoma Steel Corporation, Sault Ste. Marie, Ontario, has large iron-ore deposits along the Algoma Central Railway. Among these is the Helen property, where diamond drilling has indicated 100,000,000 tons of siderite. Experiments have shown that when roasted this provides a very satisfactory furnace product, and in view of the bounty promised by the Ontario Government, this deposit will undoubtedly be utilized sometime.

Increased Production of Phosphate Rock in 1925

THE total quantity of phosphate rock mined and sold in the United States in 1925 was 3,481,819 long tons, valued at $11,545,678, according to the U. S. Bureau of Mines. The figures indicate an increase of 21 per cent in quantity and of 13 per cent in value compared with the record for 1924.

Imports of phosphate rock in 1925, which were 2,735 long tons, valued at $37,932, indicated a decrease of 83 per cent in quantity and of 79 per cent in value. Exports amounted to 922,655 long tons, valued at $6,559,360, an increase of 13 per cent in quantity and 28 per cent in value, compared with the figures for 1924.

There are also very large pyrite deposits in this section. The Algoma Steel Corporation has one property where drilling indicated 1,000,000 tons of 46 per cent ore in a single lens. The Nicholls Chemical Co. also has a large acreage on a royalty basis. This was very actively developed during the war, and heavy shipments were made. Recent substantial increases in the price of Southern sulphur leads to the belief that these pyrite properties may again be worked in the near future.

The district is well served by electric power. The Insull interests, of Chicago, have purchased the Algoma power plant. A line has been built into the Minto mine and a 33-mile transmission line has also been built to the Goudreau district, where the company is prepared to supply power at a reasonable rate.

Lake Ore Shipments Not Equal to Those of Last Year

Iron-ore shipments from the Lake Superior district to Lake Erie ports during May and for the season to June 1 showed a heavy falling off compared with those of last year. May shipments were 6,122,645 tons, against 8,813,984 tons last year. Representatives of mining companies are sanguine that the season's tonnage will approach last year's figures of 54,098,000 tons and the Oliver Iron Mining Co. and the independents are increasing their crews at the mines and are arranging for heavier shipments from the docks from now on. Owing to low ore prices, operations on the Mesabi range are being confined to the open-pit mines, but larger shipments than during 1925 are scheduled for Cuyuna range manganiferous ores. The labor situation at the mines is good.

Cereals Grow Profusely in Large Part of Alaska

The popular conception of Alaska as a frozen, inhospitable wilderness, worthless for agricultural purposes, is giving way to a more favorable view as the result of experiments carried on by the agricultural experiment stations of the Territory, says the U. S. Department of Agriculture. Even as late as 1899 it was considered an impossibility for cereals to grow so far north, according to Bulletin No. 6, "Cereal Growing in Alaska," by C. C. Georgeson and G. W. Gasser, staff officials of the Alaska experiment stations.

The Yukon, Tanana, and Matanuska valleys have fully demonstrated their adaptability to grain growing, and it is probable that the Susitna and Kuskokwim valleys also are suited for grain cultivation on a large scale. By using hardy, early-maturing varieties of barley, oats, and spring wheat, a considerable quantity of these grains is now produced. On the other hand, Southeastern Alaska, as a whole, is not suited to grain growing, because heavy precipitation in late summer and fall renders it difficult to harvest the crops in good condition. Furthermore, there are no extensive areas in this part of the Territory which can be cleared and cultivated at a moderate cost.

Calumet & Hecla Unwatering No. 4 Calumet Shaft

Calumet & Hecla, Calumet, Mich., is installing pumps to drain the bottom of No. 4 Calumet conglomerate shaft, which has been idle since it was badly damaged by fire from the 51st to the 72d level in September, 1924. The extensive areas of stoping ground in the bottom levels of this shaft can be mined and hoisted through the Red Jacket shaft. It is estimated there are between fifteen and twenty million gallons of water to be pumped. The shaft is bottomed at the 94th level.

Seneca Employs 325 Men

Seneca Copper, near Mohawk, Mich., has brought its force up to 325 men. The force will be increased by probably 100 later in the summer upon the completion of the new compressor plant. This will permit expansion of operations and a daily tonnage of approximately 2,000, sufficient to supply three stamp heads in the mill. To reduce replacement costs, Seneca is experimenting with various types of drills to select one best suited to its needs.

Danish Flint Pebbles Arrive at Lake Linden

The steamer "Hansa," direct from Europe, recently brought a cargo of 1,500 tons of Danish flint pebbles for the Calumet & Hecla Consolidated's regrinding mills at Lake Linden, Michigan.

Needle Mountain Property Leased to Rico M. & R. Co.

Superintendent Walker of the Rico Mining & Reduction Co. of Rico, Colo., has secured a bond and lease on the Whiting group of 72 lode claims in the Needle Mountains. It is said that this group contains some of the largest lead-zinc deposits in the West. The group was worked years ago, but, owing to the low price of zinc and lead, the work was not continued. George Rowe and Dan Cason have located ten lode claims containing exposed veins of lead and zinc. These veins are from two to eight feet in width and some of the claims have as many as four veins.

News From Washington

By PAUL WOOTON
Special Correspondent

Penalty Duty on Pig Iron May Cause Retaliation by Foreign Countries

IN APPLYING the penalty-duty clause of the tariff act to Indian pig iron the Treasury Department seems to have fired the first gun in a world tariff war. This action was followed by declaring countervailing duties on German pig iron and on various manufactures of iron and steel. Formal protests are being made by the countries affected. If these are ineffectual they are expected to resort to retaliation. Other countries realize that their turn may be next. It is presumed that they are getting into a position to strike back. In Germany the bounty is paid on exports by the manufacturers from the high prices charged domestic consumers. The government has nothing to do with it whatsoever.

It is feared that this newly adopted policy of the Treasury Department in applying the penalty clause to major commodities will pave the way for similar action against the export quotas of our industries, which in many instances necessarily are offered abroad at lower prices than those prevailing at home if competition is met. Some are wondering if there is any justification for laying open all the export industries of the United States to retaliation to benefit an industry which produces ninety-nine times more than the aggregate of the imports.

The British frankly publish export prices which are lower than those quoted for domestic delivery. If the new policy is carried forward consistently it would apply to them.

Japan May Penalize Indian Pig-Iron Imports

Pig-iron producers in India also are facing action by Japan similar to ours. The Indian Government, however, already is moving to equalize the situation. Its tariff is being modified, and doubtless many a barrier will be thrown across the path of American trade which has been developed by dint of perseverance and great expense. In imposing duties and penalties one country can be just as rough as can another. Prospects point to a situation in which every country will have to be much more self-contained than at present, unless the foolishness of carrying a tariff policy too far should be impressed upon legislators. Just why the United States should coddle numerous manual activities when it does not have the labor to man its mechanized, mass-production industries is not clear. The suggestion is made that we might let the Germans beat more of our gold leaf and in return get some tariff concession from them, which would be a real benefit to us. Likewise, disinterested economists point out the fallacy of tariffs on raw materials where our reserves are inadequate to meet our needs. Tungsten is one example.

Freight rates applied on certain movements of crude mine-run fire-clay, in carloads, destined to Fort Smith and Van Buren, Ark., have been found unreasonable by the Interstate Commerce Commission. The complainants were the Athletic Mining & Smelting Co. and the Falcon Zinc Co. The clay is used in making retorts.

The commission has also prescribed reasonable rates on tin-plate scrap from Baltimore to Carteret and Sewaren, N. J. Former rates had been attacked by the Metal & Thermit Corporation, which conducts detinning operations. The new rate prescribed is $2.475, which is made retroactive to July 1, 1922.

Senate Passes Bill Allowing Oil Leases on Unallotted Indian Lands

Under the terms of a bill recently introduced in the U. S. Senate by Senator Cameron, of Arizona, as amended by the committee and passed by the Senate, all money received from oil and gas mining leases would be deposited in the Treasury to the credit of the Indian tribes the same as the income derived from leases on treaty reservations. The bill also authorizes the state in which the lands are located to levy a production tax on all the oil produced within the state, including that of the lessee or oil operator.

Senator Cameron, in his report, stated that "the bill as reported to the Senate is fair and equitable to the Indians, to the states where the Indian reservations are located, and to those who desire to prospect for oil and gas."

Minnesota Royalty Tax Held Constitutional

In a decision rendered June 7 through Justice McReynolds, the U. S. Supreme Court sustained the constitutionality of the royalty tax imposed by the State of Minnesota on iron and other ores, thereby affirming the decisions of the lower federal courts.

The Lake Superior Consolidated Iron Mines and various other companies filed suits to resist the act of the Minnesota Legislature of 1923 assessing a tax against royalties received from mining rights in the state, on the ground that the tax was violative of the Fourteenth Amendment in that it was discriminatory.

In its decision, the Supreme Court held that ore has distinctive characteristics and that a tax directed against royalties from its mining is not unduly discriminatory, citing the court's action in upholding a tax on anthracite coal as distinct from bituminous coal. The tax is important to the state, as more than $16,000,000 was paid as royalties on mining leases in 1923.

Old Dominion Concentrator Being Enlarged

By next August additional milling capacity now being installed at the Old Dominion concentrator snould be completed. This will increase milling facilities 300 tons a day and will bring capacity of the concentrator up to 1,600 to 1,700 tons of ore daily. This will result in an increase in copper output to 3,000,000 lb.

The Old Dominion company, Globe, Ariz., has made marked progress during the last two years in reducing costs and rehabilitating its reduction works. On the present 14c. price of copper it is making substantial monthly profits. It has today in net current assets $1,500,000, the bulk of it in cash and copper, and owes nothing.

Calumet & Arizona Installs Largest Hoist in District

Calumet & Arizona's (Warren, Ariz.) new double-drum electric hoist will be installed at the Junction shaft in the coming week. Forms for the hoist were constructed several weeks ago. The new hoist will be the largest electric hoist in operation in the district. The equipment was built by the Allis-Chalmers company at Milwaukee, Wis., and shipped to Bisbee, Ariz.

Shattuck-Denn Company Buys Large Air Compressor

The Shattuck-Denn Mining Corporation, Bisbee, Ariz., has purchased a 2,000-cu.ft. Sullivan air compressor to increase the capacity of its development work at the Denn shaft. The new compressor will be installed and in operation within ninety days.

Production at the Denn shaft showed up well during May, with a fair amount of development work undertaken. When the new compressor is installed development will be extended.

Tomboy Mine Will Not Close

False rumors circulated at Telluride, Colo., regarding the Tomboy mine, in Savage basin, San Miguel County, have made it necessary for the management to post the following notice:

"Reports have recently been circulated to the effect that this property is about to close. No closing is expected this year, and when closing time arrives the information will be given out by the management as many months in advance as possible. In the meantime plans are under way to prolong operations indefinitely."

The notice is signed, "Tomboy Gold Mines Co., Ltd., by N. S. Kelsey, Manager."

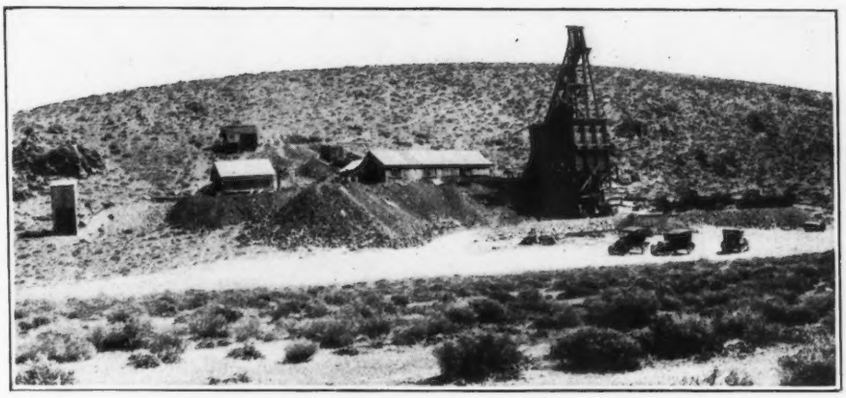
Premier Gold Declares $400,000 Dividend

The Premier Gold Mining Co. has declared a dividend of $400,000, covering operations for the second quarter in this year and payable on July 3 to stockholders of record at the close of business on June 18. The company will not purchase the Indian Mine, which it had under option.

Many Claims Staked at Quartz Mountain, Nev.—Fancy Prices Paid for Some

The recent developments on the 250 level of the San Rafael Development Co.'s mine at Quartz Mountain, Nev., has stimulated interest in both the land and in the stocks of companies holding property in the district. There is now nine feet of shipping ore exposed. About four feet of the vein is of much better grade than any ore developed on the upper levels, and five feet is of about the same grade as the ore developed on the upper levels.

Claim owners are jubilant, and acreage has risen in price. Many of the



San Rafael Mine, near Quartz Mountain, Nev.

Divide district companies which were organized in 1919 and 1920 to develop acreage in the Divide or Gold Mountain mining district, about five miles from Tonopah, Nev., and which have been dormant since that boom burst, have gathered in some close-in ground and are preparing to start work. The L. D. Gordon and George Wingfield interests, which control the San Rafael company, have secured most of the territory immediately to the northwest, on the strike of the vein, and have effected several new incorporations to develop this ground. The district extends ten miles to the southeast, to the old Illinois mine, and is all located.

Claims are selling for from $500 to $5,000 each, which is not bad considering the almost complete absence of development work and surface showings. To the north and west the district is located to and through the old Broken Hills district, three miles from Quartz Mountain. All told, an area probably fifteen by five miles, most of which shows some mineralization, is held under location or purchase. Only a small amount of work has been done as yet, and very little has been started.

A New Mining Camp in California

A new mining camp known as Silver Glance, in Section 2, Township 7 North, Range 7 West, 26 miles from Victorville, Calif., began its existence on April 23, 1926, when A. J. Bovard discovered high-grade silver-lead ore on a claim staked by him. A half interest in Mr. Bovard's claim was recently sold for $15,000, and development work has been begun. The cost of freighting ore to Victorville is $5 per ton, and $11 from there to the smelters at Salt Lake.

Quincy Mine Developing New Lode

The new vein in the Quincy mine, Hancock, Mich., is opening up well. In No. 2 shaft, at the 86th level, it has been opened in three different places. Two of these openings are on opposite sides of the shaft and the third is a raise, where the vein widens to 20 ft. The width heretofore has been 10 to 12 ft. The formation, which is part of the Pewabic series, is now designated as the East lode. It formerly was known as the Old Pewabic. In No. 6 shaft, to the north, the East lode where exposed is as rich as in No. 2, but only limited openings have been made to date. Recent Quincy developments are the uncovering of unusually large masses of copper in the deepest stopes in No. 6 shaft. A 35-ton mass has just been mined, having been cut into smaller pieces and shipped to the smelter. Other large masses are in evidence. No. 6 is richer in mass at present than at any time in its history.

Broken Hills, northwest portion of Quartz Mountain district, in Nevada

Equity Mine Reopened

The Equity mine, 7 miles northwest of Creede, Colo., is being reopened by Charles Hollister of Creede, Colo., and Edward Futterer. The mine shipped ore from 1912 to 1918, but closed down on account of scarcity of labor during the war. Workings below the tunnel level are being unwatered.

Progress Reported on Michigan Low-Grade Iron-Ore Utilization

Dr. W. O. Hotchkiss, president of the Michigan College of Mines, at Houghton, who is directing the research program for the Iron Conference of Michigan, reports progress in the iron-ore investigation. Two main problems have been left to the college for solution. One is the study of sulphur in ore with a view to its removal and the second a study of the concentrating possibilities of the low-grade ores.

Work on sulphur elimination has begun. Special equipment is being set up and analytical methods are being standardized. The sulphur impurity occurs commonly as selenite, or gypsum, and barite. More rarely the mineral pyrite is the offender. Each of the three probably will require a separate and distinct treatment.

Study of the concentration of low-grade has thus far been confined to the making of bibliographies and research into the technical literature on the subject. There has, however, been some investigation of the minerals, with special attention to the physical properties, in the hope of discovering some clew which will aid in the separation of the gangue.

Hollinger Installs Diesel Engine

Hollinger Consolidated Gold Mines, Ltd. (Toronto), of the Porcupine area, northern Ontario, has completed the installation of a 1,200-hp. Diesel oil engine, which will be used as an auxiliary power supply for pumping purposes in case of failure of the regular power supply. This engine is the largest ever installed in any of the northern Ontario gold mines. N. A. Timmins, president, and A. F. Brigham, general manager, has spent several days near Moncton, N. B., investigating the possibilities of developing copper deposits which are reported to assay $27 per ton. The deposits are at Goshen, Albert County, about 40 miles from Moncton, and were discovered some months ago. Since that time exploration work has been going on, and engineers and a chemist are being sent to the district.

British Empire Steel Has Large Deficit—Reorganization Under Way

The British Empire Steel Corporation, Ltd., Montreal, Canada, is in serious financial difficulties, and will soon be reorganized. Roy M. Wolvin, president, in the annual report for 1925, states that this course has become necessary, as the company will be unable to meet the interest on bonds which becomes due July 1 next. The operations of the several constituent companies and their subsidiaries during the year resulted in a loss of $1,133,442, which added to the deficit brought forward from last year, $1,326,588, produced an adverse balance of $2,460,031, additions to which for depreciation and depletion, $1,341,764, and for interest on bonds and debentures, $1,936,222 bring the deficit on operations since the inception of the corporation to a total of $5,738,018. The management has decided that under these circumstances a comprehensive scheme of reorganization must be adopted, including the company and its constituents and subsidiaries, a plan for which is expected to be submitted within sixty days.

Rialto Purchases Bendene Lease

The Rialto Mining Co., Cardin, Okla., has purchased the Bendene lease, located south of Baxter Springs, Kan. An interesting feature of the development of the property is that the Federal Mining & Smelting Co. took an option some months ago and did considerable drilling on it, but returned the option. Then the Rialto company did some prospecting work and struck the ore almost at the outset of its drilling activities. A good orebody has been marked out.

Oatman and Katherine, Ariz., Rival Mining Camps

New mining activity in Mojave County, Arizona, centers around the rival camps at Oatman and Katherine. At Katherine, shaft sinking is to be started immediately on the Katherine Treasure Vault property, according to M. B. Dudley, president and general manager of the company. The property is adjacent to the Katherine mine, 30 miles northwest of Kingman. The Treasure Vault vein has been opened up on the Katherine Extension property as well as on the Treasure Vault ground. Geological evidence indicates that it will intersect the main Katherine vein, which is yielding 250 tons of gold ore daily for the Katherine mine, on Treasure Vault ground. A hoist and compressor have been purchased and are being shipped to the property. Samuel I. Brethour is superintendent.

At Oatman the United Western is reported to have 225 ft. of its recently discovered vein opened up. Values average about $12 per ton. The leases on the Tom Reed property are producing $40,000 per month, of which $30,000 is coming from the Shank-Schmidt lease. These leasers have opened up new ore reserves in a winze which was sunk below the stopes which are being mined at present. The Gold Dust mill is about ready for operation. Other properties at Oatman where promising development work is being done are the Lucky Boy, Oatman United, and Oatman Eureka.

Rand Mining Industry Handicapped by State Legislation

According to Sir R. Sothern Holland, chairman of the Central Mining & Investment Corporation, the Rand mining industry is handicapped seriously by state legislation, The wage act, which gives the government power to fix minimum wages and working conditions for any class of employee in the industry, was declared particularly objectionable. As both sides of the mining industry are highly organized, the act may do away with the principle of conciliation and settlement of disputes by voluntary agreement, according to the chairman. The Miners Phthisis Consolidation Act, 1925, was criticized as putting an excessive burden on the mines. He also assailed the Mines and Works Act Amendment Bill, which prohibits natives and Asiatics being employed in occupations which the governor general thinks should be reserved for Europeans.

If the government does not wish to hasten decline of the industry and to lose its substantial revenue, according to Sir A. Sothern Holland, it must (1) prevent seasonal shortages of native labor by allowing the temporary importation of Portuguese natives; (2) reduce the crushing burden imposed on the industry by the Miners Phthisis Act; (3) modify the Wage Act, and (4) grant government mining leases on more favorable terms.

Argonaut Mine Shipping Ore from 875 Level

The Argonaut mine, at Kirkland Lake, Ontario, is developing good ore at depth. Ore of excellent grade has already gone to the mill from the 875 level, and indications are pointing to a wider body of ore at this horizon than was obtained on the 750 level. The 1,000 level is now in the mineralized zone, and promises to become a producer in the near future.

Rico Increases Activity

Rico, Colo., the town that was "raised from the dead," is busy. April shipments totaled 64 cars; 34 from Falcon Lead Mining Co., 26 from Rico Argentine property, and four from Union Carbonate. The International Smelting Co. has leased the Pro Patria mill and will remodel it to a 250-ton selective-flotation plant to treat Falcon and other custom ores.

Portland Mine to Sink

Portland Gold Mining Co., Victor, Colo., will sink a 150-ft. winze to open a level 135 ft. below the 3,000 level. The drift south on the 21st or Roosevelt level is now approaching Independence shaft. In July a 300-ft. raise from this level will be started to conenct with the shaft.

Earnings of Tintic Standard for First Quarter of 1926 Increased

The Tintic Standard Mining Co., Salt Lake City, Utah, will pay its second quarterly dividend of 40c. a share, or $461,166, on June 26 to stock of record June 16, and increase its grand total of dividends to $6,791,199. The record of the company during the first quarter is significant from the fact that, notwithstanding lower prices of metals, net earnings, after depletion, depreciation, and taxes, amounted to $576,907, compared with net earnings of $499,326 for the first quarter of 1925. Production amounted to 9,073,000 lb. of lead and 819,015 oz. of silver during the first quarter of last year. During the first quarter of 1926, the company produced 9,247,255 lb. of lead and 946,578 oz. of silver.

Earnings of the company during the first quarter of the current year were at the rate of $2,307,628, or approximately $2 a share. Dividend requirements were $1,959,955, or $1.70 a share, leaving at this rate of earning and disbursement approximately 30c. a share of $400,000 for surplus.

Federal Mining Relinquishes Option on Atlin Stock

The Federal Mining & Smelting Co. has relinquished its option on 55 per cent of the stock of Atlin Silver-Lead Mines, which owns a large consolidation of claims along Fourth of July Creek, fourteen miles from Atlin, B. C., and is withdrawing from the district. The Federal company has had this stock under option on exceptionally favorable terms for more than a year, during which it has erected a camp and mine buildings and has done a considerable amount of exploration and development.

Consolidated Mining Forms New Subsidiary

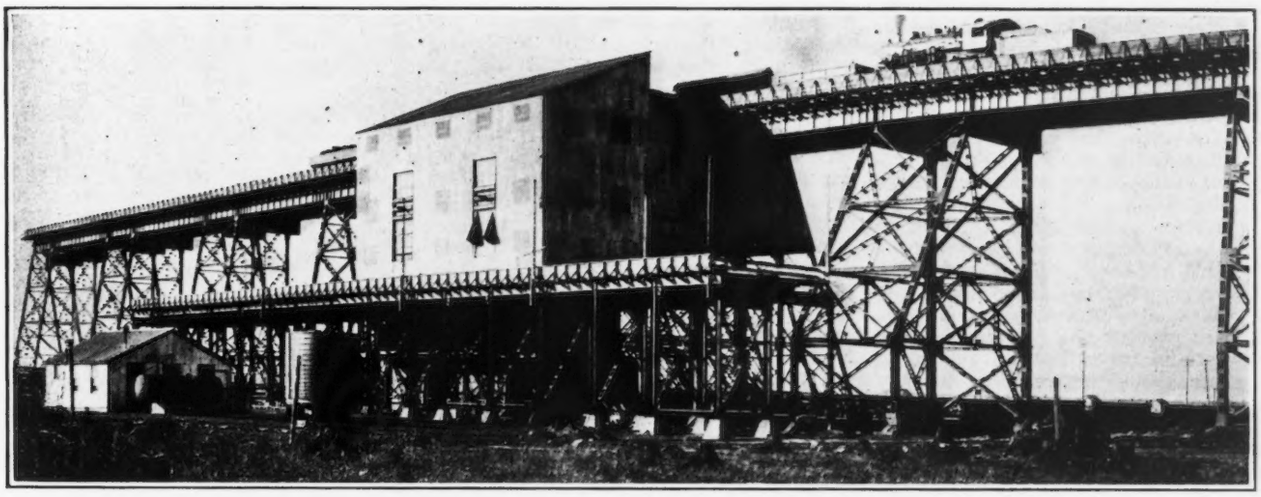
The Consolidated Mining & Smelting Co., of Trail, B. C., has formed the T. Conners Diamond Drilling Co. as a new subsidiary. The new concern will undertake all the diamond-drilling work for the Consolidated company, and, it is understood, also will undertake some custom work.

Controlling Interest in Arizona Hillside Mining Co. Sold

Control of the Arizona Hillside Mining Co., Hillside, Ariz., owning a property embracing several hundred acres near Prescott, Ariz., has been sold by Job Winwood, Earl R. Pembroke, and associates to Chester R. Bunker, of Fort Worth, Tex. To date this property has had a production of nearly half a million dollars' worth of high-grade zinc ore. A 30-mile wagon haul to the railroad and the distance from the nearest zinc smelter at Amarillo, Tex., has prevented profitable operation in the past. However, the Bunker interests believe that by deep exploration a large copper deposit can be opened up, since the geology is similar to that existing in the large producers of Jerome, Ariz.

New Crushing and Screening Plant of Oliver Iron Mining Co., Hibbing, Minn., Largest on Range

THE largest crushing and screening plant on the Mesabi range was completed at Hibbing, Minn., during the 1925 season, and is used for all of the Oliver Iron Mining Co. mines in the Hibbing district. This plant was necessary because of the chunky ore in the open pits, especially in the lower strata of the orebodies. It also eliminates furnace trouble due to size, as no lumps larger than seven inches in diameter can get into the ore cargoes. Some ore contains large pieces of taconite, and the plant layout is such that these can be removed before they reach the crushers. The arrangement is so complete that the pit shovels can load to their maximum capacity any material they may encounter and all crushing and separation can be made at the plant.



The two-unit crushing and screening plant of the Oliver Iron Mining Company, Hibbing, Minn.

The plant is one mile west of Hibbing, and on the state highway. The approach from the mines passes over the Hull-Rust dumps and enters the plant over a fill containing more than 2,000,000 cu.yd., and wide enough for double trackage. A 400-ft. viaduct partly shown in the picture connects this fill with the building at an elevation 90 ft. above the foundations. The building is 87 x 109 ft. and is built so the approach tracks and pocket openings are not covered.

Beneath the tracks are two pockets, one for each crusher, large enough for a train of crude ore. At the bottom of each bin is an 8-ft. pan conveyor driven by a 125-hp. motor, which draws the material from the bin to a steel-bar grizzly that allows material smaller than 7 in. in diameter to fall through into bins below while the chunks pass on to a second pan conveyor which elevates them to the crusher if they are ore, or passes them to the waste pocket through an air operated chute if they are rock.

The crushing plant consists of two 48 x 60-in. jaw crushers each driven by a 36-in. belt from 200-hp. 440-volt motors. The concrete pier tops on which the crushers are mounted are 40 ft. above the building foundations and contain about 400 yd. of concrete. To make necessary repairs a 30-ton electric traveling crane runs above these crushers; repairs to the outside bins are cared for with a 40-ton traveling steam crane on the approach tracks. All material passing through the crushers drops into the fine-material bins under the bar grizzly screen, and the ore from these large bins is fed to the ore cars through quick-opening clamshell type gates controlled by compressed-air cylinders. These gates can be operated rapidly enough to fill a fifty-ton car while moving slowly under the pocket without stopping the train.

A separate building shown at the left houses a 500-cu.ft. automatic starting and stopping air compressor that keeps a pressure between 95 and 110 lb. In this building is also a 300 kva. synchronous converter to operate an electric locomotive on the rock disposal track, shown in the foreground, uncompleted.

Just what quantity the plant could care for in twenty-four hours has not been fully determined, as the pit shovels could not keep the bins filled. When only one unit was operating, 358 cars of 50-ton capacity were loaded in ten hours with about 8 per cent chunks. At this rate for a 150-day season the plant could handle 10,000,000 tons, but such continuous performance is not expected. In fact, with such a variety of ores and so many fee interests to satisfy it has now been decided to add a third unit to the plant. The third crusher foundation is up, and some of the steel is on the ground. This third unit will be completed this summer.

Sioux Consolidated Has Horizontal 1,800-Ft. Drill Hole

An 1,800-ft. horizontal diamond-drill hole has been completed recently for the Sioux Consolidated company, Eureka, Utah, by Egildson Brothers, of Salt Lake City. Those who are familiar with diamond drilling say it is remarkable that a distance of 1,800 ft. could be reached, as the steel required to reach out to that point weighs more than three tons. Even under changing conditions of rock the drill kept its course; otherwise it never would have been possible to have sent the hole out to such an unusual distance. E. F. Birch, manager of the company, is enthusiastic regarding the results, stating that valuable information has been secured regarding the two ore three mineralized zones which cross the property of the Sioux company.

Joplin-Miami Production Declines

With a possible weekly production of 20,000 tons, the output of zinc ore of the Joplin-Miami field has been reduced recently to less than 14,000 tons. This curtailment has been made independently by the individual companies because they were unwilling to deplete their orebodies at less than $45 a ton for zinc ore. Lead ore also has been declining, and it is believed production in this field will not get back to 17,000 or 18,000 tons a week so long as zinc ore prices remain below $47.50 a ton and lead ore below $100.

Ferromanganese Furnace Started

The Lavino furnace, at Reusens, near Lynchburg, Va., has been put in blast, employment being given to 125 men. The plant was idle for about a year, during which time extensive repairs and improvements were made. The furnace manufactures ferromanganese.

Huttig Lead to Build Mill on Beck Lease

In the last four years, the Huttig Lead & Zinc Co., Baxter Springs, Kan., with mines located northwest of Picher, Okla., in the Joplin-Miami field, has paid off an indebtedness of $200,000 and has paid dividends of $969,000. A statement to this effect was made recently by A. Newman, of Kansas City, vice-president of the company. The Huttig directors have approved the plan to take over the Beck lease, south of St. Louis, Okla. A mill will be constructed on the property in the near future.

London Letter

By W. A. Doman
Special Correspondent

Lena Goldfields Subject of Derogatory Propaganda from Paris

London, June 1—On a previous occasion I mentioned that there were two parties interested in Lena Goldfields, one to support the shares, and the other to depreciate them. Also, reference has been made to the forged share certificates put into circulation on the Continent. The attacks on the company have not yet ceased. A journal named the *Russian Times*, printed in the Russian language, but published in Paris, under date May 21 contains an article dealing with the Lena. It alleges that the forged shares had a great sale in London; this I doubt, as no statement to support it has come to my knowledge. It further states that serious differences have arisen between the Soviet Government and the board of the company. Says the writer of the article: "The circumstances which have resulted in the work of the concessions becoming impossible are these, in brief: A band of 125 men was sent from Irkutsk to the mines, and demanded from the management that the company should employ them, and that no report of the affair should be made to London. All the plans and calculations made in London have met with complete failure." The constructional program was estimated to require £400,000 for 1926. "At the end of 1925 £300,000 were transferred to Moscow, but toward the end of February a telegram was received in London requesting a further draft of £300,000 as the whole of the first sum had already been expended." This created a panic, says the article, and "Mr. Benenson, the chief shareholder, spends his time between the banks of London and New York looking for new financial means, and meeting everywhere with refusals."

What can be the object of these statements is not easy to determine. Inquiries made at the London office of Lena Goldfields, and in other quarters likely to have some acquaintance with the working of the concession, have met with an unqualified denial. The statements are regarded as too ridiculous to need attention, apart from the fact that shareholders may be misled. One or two points are worth mention. An English and not an American group put up the funds for the resumption of operations, and the mine has been producing for some months. From now onward a monthly profit statement is promised. The London market has not taken alarm; it is, however, closely watching events, as the Lena is the first of the Russian mining companies with permission to resume work on the old concession.

Following on my reference last week to the Panama Corporation, it is announced that J. J. Calderwood and his staff, including Dr. J. McLelland Henderson and A. P. Griffiths, have left for the properties.

Dr. Malcolm Maclaren, the consulting geologist of the New Consolidated Goldfields, has left for South Africa to report on the company's interests in the Transvaal, and later will visit Rhodesia on behalf of the Goldfields Rhodesian Development.

The tin position would appear to have undergone a slight improvement, as the Greevor mine (Cornwall) has resumed operations on a limited scale, the smelters in Cornwall having announced that they are prepared again to accept tin concentrates in small quantities.

Submarine Tin-Mining Project Proposed

According to reports to the U. S. Department of Commerce, the government of the Netherlands East Indies has been considering the exploitation of the tin-bearing areas on the sea bottom in the immediate neighborhood of the Island of Banka. This is a result of the reported gradual exhaustion of the tin deposits on the island. An opportunity to make a start in this undertaking was offered the government with the dredging of a channel near Tobali, on the south coast of Banka, by the firm of Volker & Houdijk, engineers and building contractors, in January of this year. It was then decided to bring the submarine tin deposits to the surface for delivery to the government mining industry on the island. This is believed to be a forerunner of a systematic exploitation of the tin deposits on the sea bottom. A proposal to this effect has already been made to the government. Two new dredges of large capacity are also to be added.

Silver King Coalition Pays Dividend No. 43

A dividend of 25c. a share, the second regular quarterly disbursement for the current year, has been declared by the Silver King Coalition Mines Co., payable July 1 to stock of record June 21. This dividend, No. 43, amounting to $304,025, will bring the grand total of disbursements up to $19,454,910.

New Nitrate Prices Announced by Chilean Producers' Association

The Chilean Nitrate Producers' Association has fixed the prices of nitrate of soda for the year ending May 31, 1927, at one penny, English currency, per metric quintal (220.46 lb.) less than the prices which have prevailed during the year ended May 31, 1926, states the U. S. Department of Commerce. The small reduction announced is equivalent to less than one-half of 1 per cent of the previous prices.

Although the selling prices in Chile, which are quoted in sterling, have been about the same for several years, the price in the United States has moved upward with the rise in the rate of exchange for English currency. For example, the pound, which was worth approximately $4.32 in June, 1924, is now at par, or approximately 12 per cent higher. The June price is £19 2d. per quintal for 95 per cent nitrate, delivered alongside ships at Chilean nitrate ports.

Johannesburg Letter

By John Watson
Special Correspondent

April Daily Gold Production Shows Slight Increase

Johannesburg, May 11—The following crushing results, for the month of April, from thirteen leading Rand gold mines, have recently been published. The mines are arranged in order of profits earned:

	Tons Crushed	Value or Revenue £	Costs per Ton s.	Costs per Ton d.	Estimated Profit £
New Modder...	127,000	296,920	18	10.6	177,028
Government Areas.....	160,000	310,791	17	9.4	170,031
Crown Mines...	219,000	281,601	18	6.6	78,466
Modder Deep...	42,700	96,630	15	4.0	63,846
Springs.....	66,000	123,893	19	8.1	58,974
New State Areas	72,000	126,194	20	4.4	53,187
Modder B.....	65,000	113,308	18	7.0	52,923
Brakpan.....	81,200	129,936	19	3.2	51,701
Van Ryn Deep..	65,400	104,742	17	0.4	50,229
Geduld.....	79,500	115,028	17	1.0	47,048
City Deep.....	94,500	144,702	23	4.0	34,448
West Springs...	47,000	72,890	18	11.9	28,267
Robinson Deep..	74,200	.....	18	6.4	27,593

The output of Transvaal gold for the month of April was 803,303 oz., having a value of £3,412,214. These figures are decreases of 31,037 oz. and £131,837 value, compared with March. April (including Good Friday) had only twenty-five working days, compared with twenty-seven in March. The daily average output for April was an improvement on the previous month equal to over £1,000 per day. The native labor returns show an increase of 2,624 "boys" working on the Rand gold mines on April 30, compared with March 31.

Science Meeting July 5 to 10

The South African Association for the Advancement of Science will hold its twenty-fourth annual session at Pretoria, July 5 to 10, under the presidency of Dr. E. T. Mellor. In addition to addresses, lectures, and papers, arrangements are being made for excursions to Harte-Veestepoort Dam, the Pretoria Mint, Electric Power Station, the Aerodrome (Roberts' Heights), the Norite Pyramids, the Premier Diamond Mine, and the Salt-pan Soda Works.

On the Johannesburg Stock Exchange, during the past week, the share market was depressed, owing to the general strike in Britain. The leading gold stocks have, however, remained firm. T. C. Lands were 6d. higher and Potgietersrust platinums were 2d. lower on the week's balance.

Seneca Continues Development

The Seneca Copper Co., Mohawk, Mich., will have a third shaft in service at an early date. (Formerly Gratiot No. 1, which now is designated No. 3.) The surface plant is intact and is being put in condition for use. An air pipe line has been laid from shaft No. 2. Some of the levels are quite well opened and the ground throughout looks good. Still farther north is another shaft, which will be held in reserve. A third stamp head in the little Tamarack mill is being overhauled for Seneca and will be ready when needed. Shipments continue around 1,100 tons daily.

Societies, Addresses, and Reports

Argues Against Gold Standard for India

F. Y. Robertson, of United States S. R. & M. Co., Discusses Silver Producers' Problems—Urges Governmental Participation in Monetary Conference

ON MAY 8 F. Y. Robertson, vice-president of the United States Smelting, Refining & Mining Co., addressed a letter to the directors of the American Silver Producers' Association, commenting on a letter written by F. H. Brownell, vice-president of the American Smelting & Refining Co., relative to the recent sagging tendency in the silver market. Mr. Brownell suggested that the United States Government lend support toward the rehabilitation of silver subsidiary coinage in Europe through an international monetary conference; and discussed a possible visit to the United States of the Royal Currency Commission of London in connection with the establishment of a gold basis for India. The following is from Mr. Robertson's letter:

On April 13 I wrote one of our London friends in relation to the probability of the Royal Currency Commission placing India upon a gold basis, and if their recommendation should be favorable to a gold basis, inquired what were his views as to the effect that it would have upon the use of silver by the Indian population and the increase or decrease of the purchase of silver for shipment to India.

Effect of Gold Standard in India

If India were placed on a gold basis, is it probable that the silver now hoarded by the masses of India's population would come out of hiding and be replaced by gold upon the theory that the greater always displaces the lesser?

From the reports by the United States Treasury of the gold movements to India beginning with 1919 to 1925 inclusive, it would seem that the enormous sum of $1,128,812,729 in gold has been shipped into India, while during that same period only $182,816,240 had been exported, leaving a balance of gold remaining in India of approximately $944,000,000. I give below a table of gold imports and exports:

	Imports to India	Exports from India
1919	$58,201,000	$54,324,208
1920	267,288,418	37,404,639
1921	34,303,684	89,904,812
1922	146,958,641	360,358
1923	191,466,980	657,329
1924	220,642,006	1,164,894
1925	209,952,000	.....
	$1,128,812,729	$182,816,240

For the four years 1922 to 1925 inclusive, shipments of gold to India were $769,919,627, and the question naturally arises as to what amount of additional gold per annum would go into India over the next five years necessary to place India upon a gold basis, and what proportion of this gold would be absorbed by the native population, displacing the silver which it now holds, and which would of necessity come back as silver bullion.

Our London friends advised us that as of April 15, 1926, the note circulation in India was rupees 1,885,800,000, at exchange value of 1s, equivalent to £141,435,000 sterling, against which the treasury holds an equivalent amount in government securities, silver, and gold coin and bullion. The value of the gold coin and bullion amounted to only £16,740,000 sterling, equivalent to about $81,356,400. Deducting $81,000,000 in gold held by the treasury for note circulation, from the $944,000,000 in gold that went into India for the seven years preceding Jan. 1, 1926, it would seem that $863,000,000 in gold has been practically absorbed for industrial purposes and for hoarding, but not for currency, which renders the question of what may be available for the world's output for currency purposes a matter of much interest, as Montague & Co. have pointed out in their circular of Feb. 10, 1926.

Our London friends call attention to the small amount of the government holdings in gold, and say that the crux of the matter is the quantity of gold in the hands of the natives. They also state that the quantities of gold and silver in the hands of the natives must be enormous, for India has been an importer of the precious metals throughout the centuries, and only occasionally, as in 1921, when the high rate of exchange favored the movement, has there been any export from India except in small quantities to neighboring countries.

I quote further from their letter:

"It was in 1893 that the Indian mints were closed to the free coinage of silver, owing to the fall in the price of silver. The sterling value of the rupee was then fixed at 1s. 4d. and the government took the coinage of rupees into its own hands. At the same time sovereigns were made legal tender in India, £1 being the equivalent of 15 rupees. At first the Indian Treasury would only accept sovereigns in exchange for rupees, and it was not until early in this century that it would also give sovereigns in exchange for rupees. The gold standard in India then became effective.

"This system seemed to work successfully until the war, when the trade balance in favor of India rapidly increased, with great difficulty in securing silver and gold with which to pay for the exports from that country. Eventually, when consequently the Indian exchange had advanced sharply (at the time to over 2s. 10d.) the Commission of 1919 was appointed, which recommended the fixing of the exchange value of the rupee at 2s. 0d. This recommendation was very much criticized at the time, as it was given when the whole financial position of the world was very disturbed, while all exchanges, especially those of the East, were moving wildly.

"As a fact, the 2s. 0d. exchange has never been effective, and the actual exchange has ranged from a little under 1s. 4d. to about 1s. 6d. for many years past, the latter rate being that ruling of late.

"The commission now sitting has two main points to decide, viz.:

"(a) The rate at which the Indian rupee should be stabilized, the rate of 2s. 0d. fixed in 1919 having proved ineffective, and

"(b) Whether a gold currency can be introduced into India.

"The gold standard was introduced in India in 1893, but gold has never been current except in small amounts; but many Indian economists are now clamoring for a gold currency. It is difficult to see how this demand can be satisfied in view of the drains already being made on the world's new production of gold and the large share already taken by private Indian importers against India's favorable trade balances, and which is mostly hoarded, for the Indian Treasury has imported no gold at all for many years past. Still, it does actually hold about £16,740,000 in gold against its note issue.

"Should the unexpected happen and the commission recommend a gold currency, enormous quantities of silver would doubtless be thrown on the market by private individuals in exchange for gold, while the Indian Treasury would have to sell the bulk of its redundant silver rupees in order to buy gold for currency."

English Financiers Aware of Situation

England's financiers have undoubtedly been aware of this stupendous flow of gold into India, while financiers in the United States and elsewhere have given little, if any, thought to the effect on the monetary channels of the world of this immense amount of gold that is lost through hoarding and otherwise. With favorable trade and crop conditions in India, it is reasonable to expect that this flow of gold into the Orient will increase rather than diminish, so that within the next two decades the visible gold supply of the world may be very seriously diminished and the absorption by India serve no useful purpose—it is out of circulation for all time.

The absorption by India in the last seven years of $863,000,000 in gold, or in fact one-tenth of the world's visible gold supply, seems so important that the Washington administration, financial experts, and bankers should give the question of so large a diversion of gold to the Orient careful consideration. For centuries the Orient has been a quicksand, absorbing immense amounts of both gold and silver, and so far very little of it has been returned to the channels of commerce. It would seem very greatly to the advantage of the exchanges of the world that silver rather than gold should be absorbed by the Orient.

The world's production of gold for the last ten years, 1915 to 1924 inclusive, averaged $382,262,000 yearly, of which Great Britain produced approximately two-thirds. Should the

People You Should Know About

A. Homer Black, mining engineer of Tonopah, Nev., has returned to Tonopah from San Francisco.

Theron Wasson, of Columbus, Ohio, chief geologist of the Pure Oil Co., was in Houston, Tex., recently.

Pope Yeatman on June 8 received the honorary degree of doctor of laws from Washington University.

E. A. Julian, chief engineer for the Wingfield interests, is at Quartz Mountain, Nevada, on professional work.

Marshall D. Draper, mining engineer, of Los Angeles, sailed on June 1 for China, where his address will be Kotchiu Yunnan, China.

J. Walter Evans, mining engineer, of Belleville, Ontario, is examining properties in Hastings County, that province, for American interests.

John G. Kirchen, general manager of the Tonopah Extension Mining Co., of Tonopah, Nev., has gone to New York on business for his company.

R. L. Agassiz, of Boston, Mass., president of Calumet & Hecla Consolidated, is visiting the properties of the company in the Michigan copper district.

J. H. Rainville, of Montreal, president of the Argonaut, operating in the Kirkland Lake area of northern Ontario, has returned from a trip to Europe.

Charles B. Officer, who had been acting as engineering adviser to the president of the Sullivan Machinery Co., has been appointed chief engineer of that company.

Bancroft Gore, head of the department of metallurgy at the South Dakota State School of Mines, sailed from N. York on June 12 for Buenos Aires, Argentina.

T. S. Davey, mine superintendent of the Kay Copper Co., will assume the duties of manager of the property of that company, at Canyon, Ariz., taking the place of **T. S. Healy,** who recently resigned.

P. S. Osler, representing the Consolidated Mining & Smelting Co., of Canada, is examining claims in the Goudreau gold mining area of northern Ontario on behalf of the company.

W. H. Blackburn, engineer in charge of operations at Tybo, about 70 miles easterly from Tonopah, Nev., has returned to Tybo from a trip to San Francisco and other California points.

C. H. Mace, president of the Mace Company of Denver, Colo., has returned to Denver after an extended professional trip to Washington, Oregon, California, and Arizona.

Louis Reber, chief geologist for the United Verde Copper Co. at Jerome, Ariz., has accepted a position with an English mining syndicate in Rhodesia, South Africa, where he will direct their explorations.

J. E. Warnecke, on the engineering staff of the Southwestern Engineering Corporation, of Los Angeles, has left for Poplar, B. C., Canada, to make an examination of the Bullock mines, in that vicinity.

Dr. Harvey G. Mudd, brother of the late **Seeley W. Mudd,** on June 8 received on his brother's behalf the degree of doctor of engineering which had been awarded to the late Dr. Mudd by Washington University.

Homer Wilson, in charge of operations for the Manzanal Mining Co., owned by San Francisco interests, has returned to the mine, which is situated at Manzanal, 24 miles southeast of Cananea, Sonora, Mexico.

Arthur W. Stevens, mining engineer, has returned to Boise, Idaho, after making a complete examination and report of the Golden Seal group of claims, near Boise, and will later examine the McCarthy mine, also in Idaho.

F. L. Ransome

F. L. Ransome, professor of economic geology at the University of Arizona, expects to spend the latter part of June in Butte, Mont., and in July and August to do some geological work for the Ahumada Lead Co., at Los Lamentos, Mexico.

Dr. George P. Merrill, head curator of geology in the National Museum, under the Smithsonian Institution, represented the Smithsonian and the Geological Society of America at the fourteenth International Geological Congress recently held in Spain.

Dean E. Winchester, consulting geologist, is back at his office in Denver after a week's absence during which time he made a hurried inspection of the Texas Panhandle district. Mr. Winchester is specializing in the geology of petroleum, oil shale, and coal.

Myron R. Walker, a mining engineer on the staff of the U. S. Tariff Commission, will spend the next two months visiting the principal fluorspar-producing districts to gather data in connection with the application for an increase in the rate of import duty.

Herbert C. Enos, formerly in charge of operations at El Oro for the El Oro Mining & Ry. Co., Ltd., has opened offices at 1216 Pacific Mutual Building, Los Angeles, to engage in consulting mining engineering work. He will specialize in operation and mine examinations.

W. Earl Greenough, mining engineer, who has charge of the development of the Atlas mine, near Mullan, Idaho, has just completed a residence and an office building at the mine. Mr. Greenough will make his residence at the mine until completion of the present development program.

Gordon R. Campbell, president of Calumet & Arizona and New Cornelia, **James E. Fisher,** secretary, and **E. J. Collins** and **F. J. Kohlhaas,** directors, all of Calumet, Mich., attended the recent annual meetings of these companies at Bisbee, Ariz., and inspected the mine and mill properties.

T. S. Healy, in charge of operations at the Kay mining property, near Canyon, resigned his position with the company on June 1. Mr. Healy, who was formerly with the Mother Lode company, in Alaska, has no definite plans for the future and will probably take a well-earned vacation.

R. M. Macaulay, of the Consolidated Mining & Smelting Co. of Canada, returned to Montreal about the first of May from a tour of British Columbia and the Western states and is now in the Rouyn district starting up the season's work on the various properties which the Consolidated company has under option in that district.

J. A. Stader has been placed in charge of lead and zinc for the U. S. Bureau of Mines. **William Weigel** will be the specialist in charge of fertilizer materials, silicia, sand, and gravel. **R. A. Sentmeyers** is to be in charge of barium, strontium, and gypsum. **J. W. Furnace** will have chronium, manganese, antimony, and tin.

Thomas J. Donahue, for many years general superintendent of the Inspiration Consolidated Copper Co., and prior to that a member of the staff of the Morenci Branch of the Phelps Dodge Corporation, resigned his position with the Inspiration company on June 1. No announcement of Mr. Donahue's plans has been made.

Carl J. Trauerman will soon leave Butte, Mont., on a combined business and pleasure trip to Casper, Denver, Kansas City, St. Louis, Chicago, Fort Wayne, Pittsburgh, Philadelphia, New York, Boston, Albany, Buffalo Detroit, and Minneapolis, and during his tour will cover the cities named for a syndicate of Eastern financial papers.

Herbert Carmichael has left Victoria for Denver, where he will study the operation of the Gordon process for the extraction of zinc from its ores. Mr. Carmichael has secured the rights of the process for British Columbia, and with associates purposes to install a plant at the old Tyee smelter, at Ladysmith, Vancouver Island, which he has under option.

E. E. Fitz-Henry, metallurgical engineer of Santiago, Chile, recently returned from the Los Sauces copper mine, where a 30-ton pilot flotation plant was put into operation. He is now completing plans for the construction of a concentrating plant for the treatment of lead ore at the mines of the Sociedad Nacional Fundicion de Plomo, Chile.

Thomas N. Miller, for several years in charge for China of the mining department of Anderson, Meyer & Co., Ltd., has resigned from that position

commission recommend a gold basis, England is therefore in a position to supply India with its requirements of coin and bullion up to at least $250,000,000 gold annually, regardless of gold produced by other countries.

The silver production of the world over the last ten years averaged about 200,000,000 oz. yearly, of which North and South America have furnished approximately two-thirds, most of this product having been treated and sold by refining companies in the United States. With the United States at present holding nearly one-half of the gold stocks of the world, we cannot believe that England, even with so large a preponderance in the production of gold, can afford to have the world's supply of gold depleted to any large extent, as would naturally result should India be placed upon a gold basis.

Gold Reserves Should Be Reinforced

The movement of gold and silver coin and bullion during the recent World War is indicative of what will take place when there is war again between the great nations of the earth: to wit, the warring countries in making their purchases of food supplies, munitions of war, etc., paid first in gold until exhausted, then in silver until exhausted, then in the obligations of the nations themselves. It is therefore obvious that nations should reinforce their gold reserves with ample stocks of subsidiary silver coinage of a standard degree of fineness. Had it not been for the United States Treasury, with its 450,000,000 coined silver dollars, 900 fine, the Allied Powers would have been sore put to it to finance their purchases in the Orient.

The United States is solidly established upon a gold basis, and it is unfortunate that its bankers and financiers have given so little attention to the silver production of this country. There is nothing that can disturb our gold basis, unless that metal should be found in such enormous quantities that its value as a standard of measure would be affected. It is said that during the period of Spain's conquest of Mexico gold was found in such quantities that the relative value of gold and silver was about one to eight; but I think that was the only time in the world's history that there was such a disturbance of the equilibrium between the two metals. Our bankers have not yet recovered from the scare of the "sixteen to one" silver ratio which Mr. Bryan inspired in his political campaign thirty years ago; his oft-repeated campaign cry of a "Cross of Gold and a Crown of Silver" is repeated to this day, and the prejudice against silver and the fear of any movement toward bimetallism is if anything stronger today than it was thirty years ago, much to the detriment of silver.

If, then, our banking friends can be made to understand that silver has a real place in the exchanges of a considerable portion of the world as an aid to gold, and especially in the subsidiary coinage of the various countries, they would not feel so unfriendly toward it. Only a small percentage of bankers and financial men generally understood the real nature of the Pittman bill—to wit, that England purchased from the United States approximately 200,000,000 oz. of silver, for which it paid the United States at the rate of $1 per ounce, and that the United States furnished this silver to England after an understanding with the principal silver producers that they in turn would sell to the United States approximately 200,000,000 oz. of silver at $1 per ounce. Many bitter articles were noted in the Eastern papers pointing out that the United States ought not buy silver at $1 an ounce from the silver producers when it could be purchased in the open market at 65c. an ounce, the so-called financial writers remaining in ignorance of a fact about which the United States Treasury could have at once advised them—namely, that the United States Treasury was only paying for silver exactly the same price that England paid the United States several years before when the emergencies of the Great War required a vast amount of silver to be used for payment of materials obtained from the Orient. Under the stress of the war and the emergencies arising therefrom, it was found that "fiat money," whether based upon index numbers or the credit of the nations involved in the war, was a "broken reed to lean upon," and again re-established the fact which has been proven over thousands of years, that gold and silver represent the only recognized standard or measure of value that is accepted the world over regardless of the credit of nations or individuals.

Debasing of Coinage Lowered Morale

The debasing by England of her silver coinage from 925 fine to 500 fine came as a distinct shock. England has always stood for a high standard of fineness in gold and silver coinage, and while the debasing of her silver coin enabled her to place approximately 80,000,000 oz. of silver on the market at a time when sterling exchange had fallen far below par, it was a decided step toward lowering the financial morale of the various European countries, in that almost without exception they followed her example.

In conclusion it seems important, therefore:

1. That our bankers and financiers should be educated to the importance of maintaining the present gold supply of the world in its present channels.

2. That the members of Congress be apprised of the danger of the diversion of immense amounts of gold to the Orient.

3. That the Washington administration should be asked to give this subject careful consideration, with the view of stemming wherever possible any extraordinary flow of gold to the Orient.

4. It should be pointed out that our bankers, financiers, and legislators should be firmly against the debasing of the silver coinage of the world.

5. That wherever possible silver should be used as an aid in increasing the amount of metallic coinage of the world, and if possible, in alliance with England, the use of silver coinage of a standard fineness should be encouraged in other countries.

Zinc Institute Names Committees

The president of the American Zinc Institute has made the following appointments:

Executive Committee

E. R. Grasselli, Chairman
Arthur E. Bendelari — John A. McCarthy
C. A. H. de Saulles — B. N. Zimmer

Standing Committees

Finance

Howard I. Young, Chairman
Fred N. Bendelari — Jesse G. Starr
J. F. Robinson — Henry S. Wardner

Membership

Arthur D. Terrell, Chairman
Percy B. Butler — Edward C. Hegeler
Edward H. Carus — William N. Smith

Development of Industry

George C. Stone, Chairman
George K. Burgess — Alexander J. McKay
Julius W. Hegeler — Edgar Z. Wallower

Statistics and Economics

William A. Ogg, Chairman
John W. Newton — Arthur Thacher
Otto Ruhl — Leland E. Wemple

Welfare and Safety Work

B. F. Tillson, Chairman
John R. Dillon — Wesley T. Landrum
Edward C. Hegeler — George O. Person

Special Committees

Publicity

C. F. Beatty, Chairman
Philip Coldren — Alexander J. McKay
Alton D. Edes — Eugene H. Wolff

Galvanizing

F. C. Wallower, Chairman
Roy De Staebler — C. A. Klaustermeyer
Alfred W. Dodd — Charles T. Orr
A. M. Gaines — J. A. Singmaster

Insurance

Albert B. Schultz, Chairman
Hugh S. Brady — Henry W. Lohman
G. W. Johnson — G. W. Sapp

1927 *Annual Meeting*

R. M. Roosevelt, Chairman
Edward J. Greve — William F. Rossman
Richard Jenkins — Arthur Thacher

Columbia Section Meets at Kellogg

A meeting of the Columbia section, American Institute of Mining and Metallurgical Engineers, was held at Kellogg, Idaho, on Friday evening, May 21, M. H. Sullivan, chairman of Columbia section, presiding. The meeting opened with a dinner, by courtsey of the Bunker Hill & Sullivan company, at which 103 were seated. Among the guests at the meeting were nine senior students from the Idaho School of Mines.

The formal program followed the dinner. Papers were read by P. C. Fedderson, of the Bunker Hill smelter, on "Ore Sampling"; by J. W. Johnson, also of the Bunker Hill smelter, on "Assaying Ore Samples"; by W. L. Zeigler, superintendent of the Hecla mill, on the new Hecla flotation mill; and by Axel P. Ramstedt, of the Day organization, on "Mine Taxation." These were followed by moving pictures of surface and underground mining operations in the Coeur d'Alene district by Harry W. Marsh, of the Tamarack & Custer company, and A. B. Hinwood, of the Bunker Hill & Sullivan.

The senior class of the Idaho School of Mines, State University at Moscow, spent four days inspecting mining and metallurgical operations in the Coeur d'Alene district, beginning on May 21, this being the first stop in a pre-graduation tour.

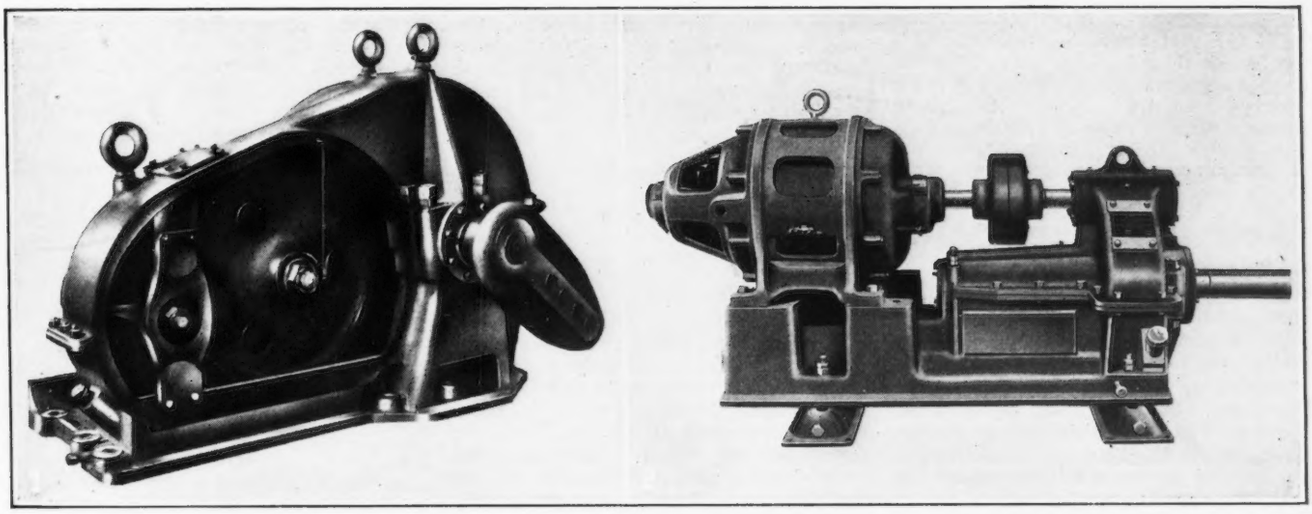


Fig. 1—In this unit gears of different ratios can be supplied on same centers to give changes in speed.
Fig. 2—Oil-well pump gear unit for electric pumping

New Machinery and Inventions

Some New Reduction Units

Almost Frictionless Drive Developed for Conveyors—Unusually High Ratio of Gears for Ball Mill Operation—Features of Reducer for Electric Pumping

SEVERAL new reduction units, recently developed by the R. D. Nuttall Co., of Pittsburgh, Pa., are illustrated in the accompanying photographs. Fig. 1 shows a new unit (the OP-12), the feature of which is that gears of different ratios can be supplied on the same centers to give changes in speed. Another feature is that the plunger stroke can be regulated in length by placing the wrist pins in different positions on the crank.

Fig. 2 shows an oil-well pump-gear unit for electric pumping. It is complete and self-contained and is made in five types, selection of the proper size depending on the motor rating. It is a single-reduction gear unit, with 5 to 1 reduction. The gear is inclosed in an oil-tight dust-proof case. The unit is mounted on a bed plate which is bolted to slide rails. The bed plate serves as mounting for the motor with which the unit is connected by means of a flexible coupling. The pinion has fifteen teeth and is integral with the shaft, which is of high-grade forged and heat-treated steel. The gear is of rolled forging and the gear shaft a hammered forging, both being heat-treated. Both pinion and gear shafts are mounted on Hyatt roller bearings.

Fig. 3 shows one of the triple-reduction units made for a conveyor drive, of which 140 have been supplied to a large mining company operating in Latin America. This unit is intended for transmitting 50 hp. at the reduction of 480 to 3. The driving pinion shaft and all intermediate shafts run in roller bearings, and the slow-speed shaft in bronze-bushed, self-oiling sleeve bearings. This unit is so nearly frictionless, it is said, that by taking hold of the driving shaft by hand all of the gears can be turned easily.

In Fig. 4 is seen a single-reduction drive built for the ball mills of the Latin American company referred to above. The gears are cast steel, with 282 helical teeth, 1¾ D.P. (diametral pitch), and 17½ in. face. The pinion is of forged steel and hardened, with nineteen teeth and an 18-in. face. The ratio is high—nearly 15 to 1—making this drive unusual.

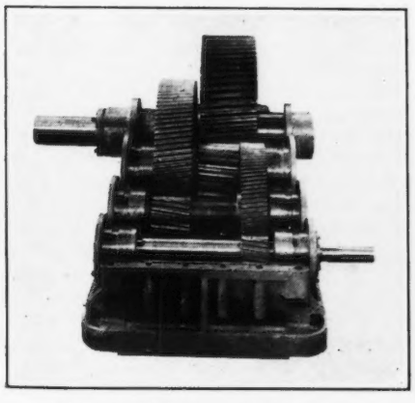


Fig. 3—Triple-reduction unit for conveyor drive

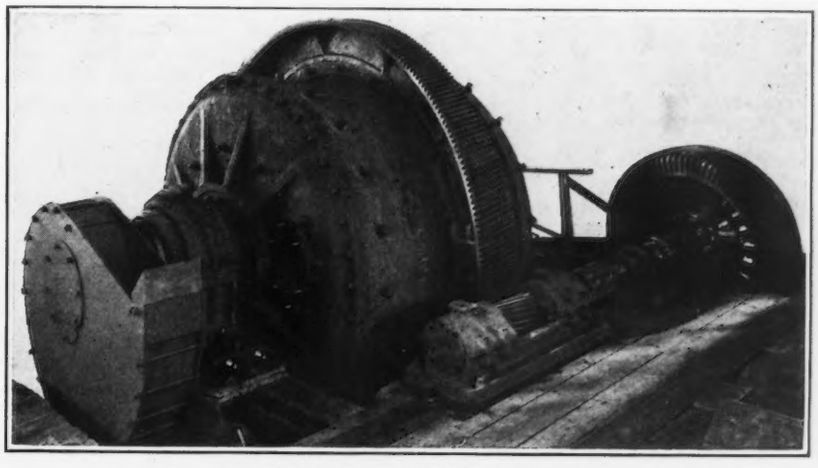


Fig. 4—Helical gears are used in this ball-mill drive

Trade Catalogs

General Equipment—General Equipment Catalog No. 24 has been issued by the Nashville Industrial Corporation, Old Hickory, Tenn.

Steel Ties—Steel ties for mines and industrial track are the subject of Booklet 31A just issued by the Bethlehem Steel Co., Bethlehem, Pa.

Arc Welding—A pamphlet describing the methods and equipment used in arc welding in the General Electric Co.'s factories has been issued by that company. It is Bulletin GEA-423.

Mining Supplies—The Mine & Smelter Supply Co. has issued a new 630-page catalog of mining machinery, equipment and supplies, pumps and air compressors, machine tools, and accessories. The various listings are arranged in order of use in the mine, mill and shop, as the engineer would naturally think of them. A section is devoted to engineering data and reference tables, and other information.

to establish consulting offices in the Hsin Chung Building, in Tientsin, China. His practice will be devoted exclusively to field examinations and plant design and construction in China, Manchuria, and Mongolia.

Dr. J. W. Gruner, assistant professor of mineralogy and geology at the University of Minnesota, is beginning on Aug. 15 his sabbatical leave. Dr. Gruner will study crystal structure and its application to mineralogy and geology with **Professors F. Rinne** and **E. Schiebold** of the University of Leipsic. En route, Dr. Gruner will present a paper before the Mineralogical Society of Germany at Duisberg.

Obituary

Thomas Higman, for many years general foreman for the Moctezuma Copper Co., at Nacozari, Sonora, Mexico, died at his ranch in Tennessee recently, following a short illness from pneumonia.

Piele Cronin, better known as Indian Pete, died at Moyie, B.C., on May 27. He was a well-known character in East Kootenay, and was the discoverer of the St. Eugene mine, at Moyie. He interested the late James Cronin and Father Cocola, and they opened the big lode up and sold it to the Consolidated Mining & Smelting Company of Canada. With his share of the profits Indian Pete built a church and turned it over to the Oblate Fathers. During recent years the old Indian fell upon hard times, so the Consolidated company, which made a large profit out of the St. Eugene mine, and expects to add considerably to that profit by treating the old tailing and waste dumps in the 500-ton mill that recently was put into operation, put Cronin on its payroll. The company was officially represented at the funeral and contributed $50 toward its expense.

Colonel Seeley Wintersmith Mudd

An Appreciation

Seeley Wintersmith Mudd was born at Kirkwood, Missouri, on August 16, 1861, and died at St. Louis, Missouri, on May 24, 1926. Thus was ended a life of activity, honor, and achievement. His host of friends, associates, and acquaintances were shocked and grieved to learn of his untimely passing. His health had been much impaired since an attack of influenza in 1918, but in other respects he was, if anything, more keenly alert and active, and many years of possibly increased activity and usefulness seemed to be before him.

No attempt will be made herein to recite his activities in the various enterprises with which he has been connected, as a very full biographical sketch appeared in the issue of *Engineering and Mining Journal-Press* of May 29, 1926.

A man who is devoted and attentive to his family has the respect of his fellow-men. The miner has faith and confidence in the man who treats him fairly, has consideration for his welfare, and is willing to give to him freely from his knowledge. Engineers respect and admire the man who by his experience and counsel can advise them in their various problems. Business men have a high appreciation of one who is able to discuss intelligently with them the conduct of large business enterprises in all their phases. Men honor the man who takes a deep interest in public activities and who is ever ready to aid in any way to promote better government and a finer citizenship. The educator, the philanthropist and the scientist esteem the man who desires to aid and advise in their great work. Some men are known and esteemed for the possession of one or more of such traits and qualities. The well-balanced man is he who measures well in all these, and thus becomes an inspiration to his

Seeley W. Mudd

fellow-men; such a man was Seeley Wintersmith Mudd.

Seeley W. Mudd represented the highest type of American citizenship. He had a most genial disposition, was courteous to and most considerate of others, loyal to his high ideals of manhood—a gentleman. Due to the fact that he was a man of energy and devoted to service, his life was one great activity and unusual achievement. His associates, whether in engineering, business, educational, or philanthropic work, sought his counsel because they recognized his ability as an engineer and his marked excellence of judgment. He took a very deep interest in educational matters and humanitarian enterprises and he had a most sympathetic understanding of the problems and needs of younger engineers, and the recollection of his words of encouragement, cheer, and helpfulness will ever be a pleasant memory to many.

Seeley W. Mudd was a man of highest integrity, and modesty and sincerity were outstanding traits of his character. He was courageous spiritually in living up to the high standards he had set for himself and in his defence of whatever he thought was right and best. His physical courage was tested and proven in some of the events in the stirring early days of Colorado mining camps.

I have been privileged to be closely associated with Seeley W. Mudd for nearly one-third of the span of his life, and I admired and respected him as a man of unusual ability, probity, and nobility of character.

Not long since, he was called upon to write a tribute to a departed friend, and in closing he quoted some lines which are repeated here, as I feel that his friends who cherish his memory will regard them as singularly appropriate in their thoughts of him:

> " . . . he went down
> As when a lordly cedar, green with boughs,
> Goes down with a great shout upon the hills
> And leaves a lonesome place against the sky."

PHILIP WISEMAN.

Colonel Seeley Wintersmith Mudd died at St. Luke's Hospital, St. Louis, Missouri, on May 24.

It is not until a thing has actually happened that we know its full import. Try all we may to prepare for it, we cannot beforehand realize all that it will mean. In the days of anxiety, hope holds in check the wave of emotion, the depth of feeling, and the enlargement of understanding borne in upon us when the event is known. It seems that something irreparable has happened.

It is not easy to describe the qualities that made Colonel Mudd so important a personality to all who knew him. He had a capacity for enjoying life which was peculiarly attractive, as it was combined with a strong and positive desire that everyone else should enjoy life too, in his or her own way. He was kind; a warm human kindness was of the very substance of the man. He inspired others to high accomplishment and sustained effort. The success or good fortune of a friend gave him great satisfaction and pleasure. Colonel Mudd possessed the unusual ability of combining dignity and ease, rare tact and sociable friendliness. He was endowed with an abundance of good sense and sound judgment. Modest to an extreme, he shunned all manner of publicity and all offices of honor.

These, it may be thought, are not very unusual qualities, but Colonel Mudd had an extraordinary power of making them felt.

He left unspoken the things that later he might wish to retract. But he was frank and straightforward. No one left his presence with any misapprehension of his meaning or his intent. He made friends, staunch friends, abundantly. He was at the peak of his profession for many years; yet he made no enemies.

His business associates admired his ability to succeed through his thoroughness, his judgment and his steadfast convictions. But there was something more; a spirit to it all that was due to his rare personality. He was a good loser, and therefore men wanted to see him win. He was an incessant worker and a deep thinker. He seldom fell short of eight or nine hours in the office and usually added four or five more hours of work at his home. He gave freely of his time to civic and philanthropic undertakings even though his many interests may have been pressing for attention.

To those who knew him well, the vivid memory of his human kindness, his cheerful optimism, his buoyant, elevating spirit, and his earnest example of industrious endeavor will last a long, long time.

He was truly a great man.

ROBERT E. MCCONNELL.

The Market Report

Active Market Sends All Metal Prices Up

New York, June 16, 1926.—Lead has been perhaps the strongest of the non-ferrous metals in the week ending today, contract prices having been advanced four times by the leading New York seller and demand being widespread. Last week's activity in copper, zinc, and tin has also continued, though the market has been a little quieter the last two days.

Copper Back to 14c.

Last Thursday and Friday it was still possible to buy copper for Valley deliveries at 13⅞c., and a good tonnage was sold at that level, and at 14c. in the Middle West. Producers then raised their price to 14 and 14⅛c., respectively, at which quotations good business has also been booked in the last few days. Most sellers are still at the 14c. level for Eastern deliveries although a little business has also been booked at from 13.925@13.975c. for June and July deliveries. Consumers are not yet much interested in August copper, and there is still a very appreciable demand for June shipment; such meager stocks in the hands of consumers were not at all common a year or two ago. Some sellers have little or no near-by copper to offer, but others apparently have sufficient to meet all demands.

The foreign market has been better than for many weeks, with Germany particularly active in buying. Prices in the last day or two have reached 14.15@14.175c., c.i.f.

Daily Prices of Metals

June	Copper N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
10	13.65	57.50	59.375	7.85	7.70	7.10@7.15
11	13.65	58.375	60.375	8.025	7.85	7.10@7.15
12	13.70	58.375	60.375	8.025	7.90	7.15@7.25
14	13.725	59.00	61.25	8.05	7.95	7.20@7.275
15	13.775	58.875	61.125	8.20	8.05	7.20@7.25
16	13.775	58.875	61.00	8.30	8.20	7.175
Av.	13.713	58.500	60.583	8.075	7.942	7.181

The prices correspond to the following quotations for copper delivered: June 10th and 11th, 13.90c.; 12th, 13.95c.; 14th, 13.975c.; 15th and 16th, 14.025c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

June	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
10	56⅞	57¾	64¾	264¼	263¼	29 11/16	29 15/16	33⅜	33 9/16
11	57	57⅞	64¾	267¼	266¼	30⅛	30½	33½	33 11/16
14	57½	58⅜	65	269¾	269	30⅝	30⅞	33 15/16	34 3/16
15	57½	58⅜	65	268¾	268⅝	30 13/16	31	34 1/16	34
16	57⅜	58¼	65	269¼	268¾	31 3/16	31¼	33¾	33¾

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

June	Sterling Exchange "Checks"	Silver		Gold London	June	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
10	4.85⅞	65⅝	30 5/16	84s11½d	14	4.86⅛	65⅝	30⅜	84s11½d
11	4.85⅞	65⅝	30 5/16	84s11½d	15	4 86⅛	65½	30⅛	84s10¼d
12	4.86	65⅝	30⅜	.....	16	4 86⅛	65⅞	30⅜	84s11¼d

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command three-eighths cent premium.

Zinc Reached 7.275c.

After the excellent buying of last week, the improved London quotations, the restricted ore production, and the higher prices of concentrates, it was natural for zinc prices to move upward. As high as 7.275c. was registered on sales for July delivery on Monday, but the market has tapered off a little since then. Galvanizers have again bought in satisfactory quantities, though reporting but little improvement in their business. Some sellers are asking slight premiums for forward shipment. Statistics issued last week by the American Zinc Institute follow:

Stock, May 1, tons	25,990
Produced	53,703
Shipped	49,759
Stock, May 31	29,934
Shipped from plant for export	4,058
Stored for customers	1,279
Retorts operating, May 31	86,279

High-grade zinc is now quoted at 8.50c. in the East.

Mild Panic Among Lead Buyers

Consumers of lead who could not be interested a few weeks ago in 100 tons of lead at 7.65c. are now anxious to buy several hundred tons at 8.25c. Producers, on the other hand, are pretty well sold for June and July and are not inclined to place business for deliveries beyond that except on an "average" price basis. Sales for the week have been exceptionally large, and producers could have booked more business had they been in position to do so. Last Thursday the American Smelting & Refining Co. increased its contract price from 7.65c. to 7.80c. This was the first upward change since Nov. 2, 1925, when 9.75c. was reached. This added momentum to a buying movement that already was under way and three subsequent increases have been made: on Friday, June 11, to 8c.; on Tuesday, June 15, to 8.15c.; and today, June 16, to 8.25c. Premium prices have been paid during the entire week, as much as 20 points above the Smelting company's price being obtained on small shipments, particularly for early delivery. The St.

Louis market has kept pretty well in step with New York, the prices quoted being weighted averages of a considerable range for each day. Speculators and dealers in London and consumers in Germany have been buyers, with the consequence that the London market has also improved steadily, the net gain for the week being about £1 5s.

Moderate Demand for Tin

The price of tin in New York has improved during the week, though buying by consumers has been small. On Tuesday fair business was reported, accompanying a slight break in the prices. Spot metal commands a premium of about ¼c. per lb. over early delivery which we quote. Three months Straits can be obtained for about 1¼c. under the price for June.

Francs Still Weak

Closing cable quotations on Tuesday, June 15, were as follows: Francs, 2.81c.; lire, 3.65c.; and marks, 23.81c. Canadian dollars, 7/64 per cent premium.

Silver Market Quiet and Steady

Silver continues quiet, but there is great steadiness to the market, particularly in New York, where sellers are reluctant. There are no new factors in the market, but the undertone remains good.

Mexican Dollars (Old Mexican Pesos): June 10th, 11th, 12th, and 14th, 50⅜c.; 15th, 50¼c.; 16th, 50½c.

Other Metals

Quotations cover large wholesale lots unless otherwise specified

Aluminum—99 per cent grade, 28c. per lb.; 98 per cent, 27c. London, 98 per cent, £118 per long ton. Slackness on Continent adverse factor.

Antimony—Per pound, duty paid, New York: Chinese brands, spot, 10½@10⅝c. July arrival, 10½@10⅝c. Cookson's "C" grade, spot, 20c. Market very dull and prices mostly nominal. Sporadic buying by consumers.

Bismuth—$2.70@$2.75 per lb., in ton lots. London, 10s.

Cadmium—60c. per lb. Market good. **London, 1s. 9d. for Australian metal.**

Iridium — $150@$160 per oz. for **98@99 per cent. Nominal. London,** £63@£65 for 99.5 per cent.

Nickel—Ingot, 35c.; shot, 36c.; electrolytic, 39c. (99.75 per cent). London, £170@£175 per long ton.

Osmium—$75@$80 per oz., nominal; London, £17@£20.

Palladium—Refined, $70@$72 per oz. As a constituent of crude platinum, $60@$65 per oz. London, £12@£15, nominal.

Platinum — Per ounce refined, officially quoted: $110. Sales also at $107 @$108. Crude, $107. London, £22@ £23½ for refined; crude, £21.

The official price of refined platinum was raised to $110 on June 10.

Quicksilver—Per 75-lb. flask holding steady at $91@$92. San Francisco, $90.67. London, £15.

Ruthenium — $75@$80 per oz.; London, £12@£15.

The prices of **Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Monel Metal, Radium, Rhodium, Selenium, Tantalum, Tellurium, Thallium, Tungsten, and Zirconium** are unchanged from the issue of June 5.

Metallic Ores

Tungsten Ore—Per unit of WO_3, N.Y.: Wolframite, $10.50@$10.60; Western scheelite, $10.75@$10.85. Little consuming or speculative demand, and prices largely nominal.

Vanadium Ore—Containing 4 to 8 per cent V_2O_5, 30@35c. per pound of V_2O_5 f.o.b. Montrose, Colo.

Foreign concentrate (lead vanadate) 12 to 18 per cent V_2O_5, 60@65c. per pound V_2O_5, duty paid, seaboard.

Chrome Ore, Iron Ore, Manganese Ore, Molybdenum, Tantalum, and Uranium are unchanged from quotations in the June 5 issue.

Higher Prices for Zinc Blende and Lead Ore

Joplin, Mo., June 12, 1926

Blende	Ton
High	$49.75
Premium blende, basis 60 per cent zinc	$48.00@49.00
Prime Western, basis 60 per cent zinc	47.00@48.00
Fines and slimes, 60 per cent zinc	46.00@43.00
Average settling price, all zinc	45.91
Galena	
High	$96.90
Basis 80 per cent lead	$95.00@96.00
Average settling price, all lead	95.11

Shipments for the week: Blende, 14,351; lead, 2,030 tons. Value, all ores the week, $852,000.

Reports from sellers that a basis price of $48 brought a considerable tonnage cannot be confirmed from buyers, but as the assertion is so pronounced, and the demand of some buyers so acute, it is quite probable $48 should be included in the Prime Western basis price. Still there are producers who have no ore for the market, and output has dropped to less than 14,000 tons per week, or 6,000 tons per week less than the peak production last February. Purchases for the week are 15,550 tons.

Buyers report the basis price of lead at $95, but it is known that one seller refused an offer of $96 basis price, and it is probable that lead not under contract sold as high or higher than $96 basis price. The low production of all mines has reduced the salable lead output, aside from contract lead, to a low point. Sellers are holding around 14,000 tons for $100 basis price or even higher.

Platteville, Wis., June 6, 1926

Zinc Blende	Per Ton
Blende, basis 60 per cent zinc	$48.75
Lead Ore	
Lead, basis 80 per cent lead	$92.50

Shipments for the week: Blende, 1,149 tons; lead, 40 tons. Shipments for the year: Blende, 24,142; lead, 672 tons. Shipments for the week to separating plants, 2,194 tons blende.

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomite, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Ilmenite, Iron Oxide, Lepidolite, Limestone, Magnesite, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystal, Rutile, Silica, Spodumene, Sulphur, Talc, Tripoli, and Zircon are unchanged from prices in the June 5 issue.

Mineral Products

Arsenious Oxide (White arsenic)—3½c. per lb. One large lot sold. London, £14 per long ton.

Copper Sulphate, Sodium Nitrate, Sodium Sulphate (Salt Cake), and Zinc Oxide are unchanged from prices in the June 5 issue.

Ferro-Alloys

Ferromanganese — Domestic, 78@82 per cent, $88@$90 per gross ton, furnace; prompt and future.

Ferrosilicon—14 to 16 per cent, $42 @$47 per gross ton, f.o.b. works; 50 per cent, $87.50 delivered in carload lots; 75 per cent, $145. Market active.

Ferrotungsten—$1@$1.05 per pound contained W, f.o.b. works acording to grade.

Ferrocerium, Ferrochrome, Ferrophosphorus, Ferrotitanium, Ferrouranium, Ferrovanadium, and Spiegeleisen are unchanged from prices in the June 5 issue.

Metal Products

Rolled Copper — Sheets, 22½c.; wire, base price, 16c. per lb.

Zinc Sheets — 11.25c. per lb., f.o.b. works.

Lead Sheets, Nickel Silver, and Yellow Metal are unchanged from prices in the June 5 issue.

Refractories

Chrome Brick, Firebrick, Magnesite Brick, Silica Brick, and Zirkite are unchanged from prices in the June 5 issue.

Steel Continues Steady—Pig Iron and Coke Dull

Pittsburgh, June 15, 1926

Steel-mill operations undergo a barely perceptible decrease from week to week. Demand has been holding up much better than is usual at this time of year. With an 80 per cent operation in the steel industry, production of steel is only 10 per cent under the highest rate ever averaged for six consecutive months.

Pig Iron—The Standard Sanitary Manufacturing Co., which recently bought 28,000 tons of local iron for its two Pittsburgh district plants, has bought 22,000 tons of Ironton and Toledo iron for its Louisville plant, at $21.65 delivered, and 3,000 tons of foreign iron, 5,500 tons of steel-works iron, and 1,500 tons of regular merchant iron, at an average of about $22 delivered, for its Baltimore plant, all deliveries being over the second half of the year. The Valley market remains stagnant. Bessemer, $19; basic and foundry, $18, f.o.b. Valley furnaces.

Connellsville Coke—The market remains dull. Spot furnace, $2.75@$2.90; spot foundry, $4@$4.50 for standard.

Freight Rates on Metals, Ores, and Concentrates

Carload Lots

Copper Bullion and Refined Copper

From	To	Rate per Ton of 2,000 Lb. All Rail	Via Gulf
El Paso, Tex.	Baltimore, Md.	$11.40	$10.00[1]
Garfield, Utah	Perth Amboy	12.50	.....
Garfield, Utah	San Francisco	5.85	.....
Hayden, Ariz.	Perth Amboy	14.50	12.50
Miami, Ariz.	Perth Amboy	14.50	12.50
Anaconda, Mont.	Perth Amboy	12.50	.....
Butte, Mont.	Perth Amboy	12.50	.....
Humboldt, Ariz.	Chrome, N. J.	14.50	12.50
Douglas, Ariz.	Perth Amboy	14.50	12.50
Globe, Ariz.	Perth Amboy	14.50	12.50
Clifton, Ariz.	Perth Amboy	14.50	12.50
Clarkdale, Ariz.	Chrome, N. J.	14.50	12.50
Via Southern S.S. Co. or Morgan Line		.....	$9.40

From	To	Rate per Ton of 2,000 Lb. All Rail	Via Gulf
Copperhill, Tenn.	Laurel Hill, N. Y.	$10.80	.....
Tooele, Utah	Chrome, N. J.	12.50	.....
McGill, Nev.	Baltimore, Md.	12.90	.....
Houghton, Mich.	New York	9.60	.....
Hancock, Mich.	New York	9.60	.....
Hubbell, Mich.	New York	9.60	.....
Dollar Bay, Mich.	New York	9.60	.....
Tacoma, Wash.	New York Conference rate		$6.00
Via Canal			
Anaconda, Mont.	Tacoma, Wash.	7.09	.....
Ajo, Ariz.	New York	14.50	$12.50

Marine Freight Rates

New York to
- Hamburg.... $4.50 per gross ton copper and lead
- Liverpool.... 5.50 per gross ton copper and lead
- Antwerp.... 4.00 per gross ton copper and lead
- Havre..... 4.75 per gross ton lead; 5.00 per gross ton copper

Gulf ports to
- Hamburg.... $4.50 per gross ton copper and lead
- Liverpool.... 5.50 per gross ton copper and lead
- Antwerp.... 4.00 per gross ton copper and lead
- Havre..... 5.00 per gross ton copper

Pacific coast ports to
- Hongkong... $6.00 per short ton copper and lead
- Kobe..... 6.00 per short ton copper and lead

Lead Bullion (Pig Lead Where Shown)

From	Rates per Ton of 2,000 Lb. To New York	To St. Louis
East St. Louis, Ill.	$7.00	.....
Pueblo, Colo.	12.50	$9.00
Leadville, Colo.	12.50	9.00
East Helena, Mont	12.50	9.50
El Paso, Tex.	10.00 Via Gulf	
	12.00 All Rail	7.00
Omaha, Neb.	9.60	3.65
Murray, Utah	12.50	9.00
Midvale, Utah	12.50	9.00
Tooele, Utah	12.50	9.00
East Chicago, Ill.	6.40	(a) 1.60
Kellogg, Idaho	13.50	9.50
Carnegie, Pa.	3.80	(a) 5.00
Selby, Calif.	(b) 6.00	.....
Herculaneum, Mo.	(a) 8.80	(a) 1.80
Federal, Ill.	7.00	(a) 1.80
Collinsville, Ill.	7.00	(a) .75½
Granby, Mo.	(a) 10.50	(a) 3.50
Joplin, Mo.	(a) 10.50	(a) 3.50

(a) Pig lead only.
(b) Conference rate, via canal.

Slab Zinc

From	Rates per Net Ton to E.St. Louis	New York
Donora, Pa.	(a) $4.60	$3.80
Langeloth, Pa.	(a) 4.60	3.80
Palmerton, Pa.	7.10	3.00
Hillsboro, Ill.	1.40	7.00
Danville, Ill.	1.60	6.40
La Salle, Ill.	1.60	6.70
Springfield, Ill.	3.00	7.00
Cleveland, Ohio	5.80	5.00
Moundsville, W. Va.	4.40	3.80
Van Buren, Ark.	3.80	10.80
Fort Smith, Ark.	3.80	10.80
Bartlesville, Okla.	3.50	10.50
Blackwell, Okla.	3.80	10.80
Henryetta, Okla.	3.80	10.80
Sand Springs, Okla.	3.80	10.80
Cherryvale, Kan.	3.50	10.50
Black Eagle, Mont.	9.40	12.50
Park City, Utah	9.00	12.50
Amarillo, Tex.	5.80	12.80

(a) To St. Louis, Mo.

Zinc Ores and Concentrates

To	From	Rate per Net Ton
Bartlesville, Okla.	Altoona, Kan.	$2.10
	Pittsburg, Kan.	1.09
	Galena, Kan.	1.30
	Joplin, Mo.	1.40
	Iola, Kan.	1.09
	Baxter, Kan.	1.50
	Miami, Okla.	1.40
	Quapaw, Okla.	1.40
	Kansas City, Mo.	1.60
Sand Springs, Okla.	Miami, Okla.	2.20
	Quapaw, Okla.	2.20
	Galena, Kan.	1.50
	Joplin, Mo.	1.50
	Iola, Kan.	2.40
Dewar, Okla.	Cave Springs, Mo.	2.00
Kusa, Okla.	Cent City Spur, Mo.	2.00
Henryetta, Okla.	Chitwood, Mo.	2.00
	Galena, Kan.	1.50
	Iola, Kan.	2.40
	La Harpe, Kan.	2.40
La Harpe, Kan.	Mound City, Kan.	.50
	Oswego, Kan.	.50
	Parsons, Kan.	.50
Coffeyville, Kan.	Galena, Kan.	1.10
	Joplin, Mo.	1.22
Bartlesville, Okla. (a)	Baxter, Kan.	1.80
	Miami, Okla.	1.80
	Quapaw, Okla.	1.80

(a) Lead ore and concentrates.

Rates on Ores and Concentrates

From	To	Value of Product: $5	$10	$15	$20	$25	$30	$35	$40	$50	$60	$70	$75	$80	$90	$100
		Rate														
Butte, Mont.	Anaconda, Mont.	.22	.22	.22	.22	.22	.22	.22	.22	.22	.22	.22	22	.22	.22	.22
Butte, Mont.	Black Eagle, Mont. (a)	....	....	.....	....	.....	....	...	1.01	.....	.....	.....	.....	.....	.....	1.01
Great Falls, Mont.	East Helena, Mont (d)	....	....	1.50	....	1.69	....	1.91	....	2.36	.....	.....	.....	.....	.....	2.48
Butte, Mont.	East Helena, Mont.	....	....	1.17	....	1.46	....	1.69	....	2.03	.....	.....	.....	.....	.....	2.14
Paxton, Calif.	Salt Lake Smelters, Utah	....	....	....	....	.....	....	.....	.....	*5.50	*6.00	*6.70	....	*7.40	*8.10	*8.80
Johannesburg, Calif.	Selby, Calif.	....	....	....	2.90	....	3.50	....	4.10	4.70	5.30	5.90	....	6.50	6.80	7.10
Johannesburg, Calif.	Humboldt, Ariz.	....	....	....	3.40	....	4.10	....	4.80	5.50	6.20	6.90	....	7.60	8.00	8.30
Pioche, Nev.	Humboldt, Ariz.	....	4.50(e)	7.74	....	8.55	....	9.36	....	9.99	....	....	11.25	....	....	12.42
Creede, Colo.	Durango, Colo.	....	....	3.25	3.50	3.75	4.00	....	4.25	4.75	5.25	5.75	6.05	....	....	7.10
Ouray, Colo.	Durango, Colo.	....	....	4.30	4.80	....	5.05	....	5.50	5.90	....	6.30	....	....	....	7.70
Telluride, Colo.	Durango, Colo.	....	....	....	....	....	4.30	....	5.00	5.50	6.00	6.30	....	6.60	7.10	7.70
Silverton, Colo.	Durango, Colo.	....	....	1.40	1.40	....	....	2.20	....	....	....	....	....	2.30	2.55	2.80
Tyrone, N. M.	Douglas, Ariz.	....	....	1.60	1.90	....	2.20	....	2.50	2.80	....	....	3.10	....	....	3.40
Tyrone, N. M.	El Paso, Tex.	....	....	1.60	1.90	....	2.20	....	2.50	2.80	....	....	3.10	....	....	3.40
Lordsburg, N. M.	Douglas, Ariz.	....	1.00	....	1.60	....	1.90	....	2.20	2.50	....	....	2.80	....	....	3.40
Lordsburg, N. M.	El Paso, Tex.	....	1.00	1.30	1.60	....	1.90	....	2.20	2.50	....	....	2.80	....	....	3.40
Tombstone, Ariz.	Douglas, Ariz.	....	....	.60	....	.90	....	....	....	1.30	....	....	1.60	....	....	1.90
Tombstone, Ariz.	El Paso, Tex.	....	1.60	1.90	....	2.50	....	....	....	3.80	....	....	4.40	....	....	4.40
Silver City, N. M.	Douglas, Ariz.	....	....	2.48	....	3.15	....	....	....	3.83	....	....	....	....	....	5.29
Ray Junction, Ariz.	Hayden, Ariz.	....	.10	....	.40	....	.50	....	.80	.90	....	....	1.00	....	....	1.10
Sandon, B. C. / Alamo Concentrator, B. C.	Tadanac, B. C.	1.50	1.60	1.70	1.90	2.00	2.50	....	2.60	2.90	3.40	3.50	....	3.70	3.80	3.90
Rossland, B. C.	Tadanac, B. C.	.90	.90	1.00	1.00	1.10	1.50	....	1.60	1.60	1.60	1.70	....	1.70	1.70	1.70
Rossland, B. C.	Tadanac, B. C(e)	.30	.30	.30	.30	.50	.70	....	.80	.80	.....	.....	.....	.....	.....	.....
Republic, Wash.	Tadanac, B. C.	....	2.11	2.56	2.66	2.86	3.84	....	3.84	3.84	4.69	4.89	....	5.19	5.39	5.59

(a) Minimum tonnage of 200 tons per day. (b) In open cars, minimum 80,000 lb. (c) Siliceous ore tailing. (d) Plus $2.70 per car switching.
(e) Applicable on ore, only when shipped in trainload lots of not less than 10 cars and exclusive of switching charges at Rossland.

From	To	Value of Ores and Concentrates: $10	$15	$20	$25	$30	$35	$40	$50	$60	$70	$75	$80	$90	$100
		Rate													
Burke, Idaho (a) (d)	Bradley, Idaho	....	....	....	....	....	....	....	....	.68	.....	.....	.....	.....	1 02
Burke and Wallace, Idaho	East Helena, Mont.	....	....	....	....	3.00	....	3.25	3.50	3.75	4.00	.....	4.25	4.50	4 75
Sagel, Idaho	East Helena, Mont.	....	....	....	3.38	....	3.83	....	4.16	.....	.....	.....	.....	.....	4.84
Arizona Tunnel, Idaho	Bradley, Idaho	....	....	....	....	....	....	....	....	.35	....	.....	....	.....	.50
Bayview, Idaho	Bradley, Idaho	....	....	....	....	....	....	....	3.75	.....	....	4.37½	.....	.....	5.12
Park City, Utah	Salt Lake Smelters	1.00(e)	1.10	1.25	....	1.50	....	1.75	....	2.00	.....	.....	2.25	.....	2 50
Eureka, Utah	Salt Lake Smelters	1.00	....	1.25	....	1.50	....	1.75	2.00	2.25	2.50	.....	2.75	3.00	3.25
Tintic, Utah	Salt Lake Smelters	1.00	....	1.25	....	1.50	....	1.75	2.00	2.25	2.50	.....	2.75	3.00	3.25
St. Johns, Utah	Salt Lake Smelters	1.00	....	1.25	....	1.50	....	1.75	2.00	2.25	2.50	.....	2.75	3.00	3 25
Ophir, Utah	Salt Lake Smelters	1.00	....	1.25	....	1.50	....	1.75	2.00	2.25	2.50	.....	2.75	3.00	3.25
Bingham, Utah	Garfield, Utah	....	.40	....	.75	....	....	....	.95	....	....	1.10	....	....	1.25
Cherry Creek, Nev.	Garfield, Utah (c)	....	....	4.60	....	5.10	....	5.60	6.10	6.60	7.10	.....	7.60	8.10	8.60
Cherry Creek, Nev.	Garfield, Utah (b)	....	....	3.20	....	3.90	....	4.60	5.30	6.00	6.70	.....	7.40	.....	.....
Goldfield, Nev.	Salt Lake Smelters	....	4.15	5.10	....	5.80	....	6.50	7.20	7.90	8.60	.....	9.30	10.00	10.70
Battle Mountain(a)	Salt Lake Smelters	....	....	*3.20	....	*3.80	....	*4.40	*5.00	*5.60	*6.20	.....	*6.80	*7.40	*8.00
Palisade, Nev. (a)	Salt Lake Smelters	2.20	2.90	3.20	....	3.80	....	4.30	4.80	5.30	5.80	.....	6.30	6.80	7.30
Mina, Nev. (a)	Salt Lake Smelters	....	....	3.60	....	4.30	....	5.00	5.70	6.40	7.10	.....	7.80	8.50	9.20
Lovelock, Nev. (a)	Salt Lake Smelters	....	....	3.20	....	3.90	....	4.60	5.30	6.00	6.70	.....	7.40	8.10	8 80
Golconda, Nev. (a)	Salt Lake Smelters	....	....	3.20	....	3.90	....	4.60	5.30	6.00	6.70	.....	7.40	8.10	8 80
Hazen, Nev. (a)	Salt Lake Smelters	....	....	3.20	....	3.90	....	4.60	5.30	6.00	6.70	.....	7.40	8.10	8 80
Tonopah, Nev.	Salt Lake Smelters	....	4.15	5.10	....	5.80	....	6.50	7.20	7.90	8.60	.....	9.30	10.00	10.00
Rogerson, Idaho	Salt Lake Smelters	3.00	....	3.50	....	4.00	....	4.50	5.00	5.50	6.00	.....	6.50	7.00	7.07
Georgetown, Colo.	Leadville, Colo.	....	....	3.50	....	3.75	....	4.00	5.00	5.00	5.80	.....	5.80	5.80	5.85

(a) Minimum weight, marked capacity of car used, but not less than 80,000 lb. (b) Minimum weight, 80,000 lb. (c) Minimum weight, 40,000 lb.
(d) Crude ore for concentration, 30c. per ton.
(e) For $9 value rate is 95c.; $8 values, 90c.; $7 value, 85c.; $6 value, 80c.
*Indicates a change of tariff since Sept. 12.

Company Reports

Yukon Gold Improves Position

The financial condition of the Yukon Gold Co. has been greatly improved during the last year, principally due to the development of the Malay tin-mining operations into a profitable venture, according to the recent report.

Dawson hydraulics: Since there was no final clean-up at the end of 1924, the results for 1924 and 1925 are combined. During the two seasons, 1,892,000 cu.yd. of gravel was mined, which yielded $366,663, or an average of 19.4c. per cubic yard. Costs, excluding depreciation, were $248,099, or 13.1c. per cubic yard. The operating profit was $118,564. With the close of the 1925 season the mining operations of the company in the Klondike district were concluded.

Idaho dredging: The one dredge on the leased property of the Cœur d'Alene Mining Co. mined a total of 1,311,089 cu.yd., which produced $116,461 at a cost of $87,390. Total operating profits for the year were $29,071.

Nevada lode mines: During the year, mining operations were conducted in the Long Hike mine of the Elkoro Mines Co., and also in the property of the Jarbidge Gold Mining Co., Ltd. A total of 53,592 tons was milled, which yielded $556,066. The average value of the ore milled was $10.38 per ton. The total cost of mining and milling, excluding depreciation and development, was $283,457, or $5.29 per ton. There was charged off in connection with current development work $44,166, leaving an operating profit of $228,443. Development work during the year failed to add any appreciable quantity of commercial ore to the reserves.

Malay operations: Two dredges were in operation throughout the year, Dredge No. 2 at Kampar, and Dredge No. 4 on the Ulu Klang property near Kuala Lumpur. The dredges mined 52 acres of ground, containing 2,547,800 cu.yd. of alluvium, which produced 2,594,597 lb. of 73.4 per cent concentrate, an average of 1.02 lb. per cubic yard. The concentrate yielded 1,904,868 lb. of metallic tin. The amount realized from the sale of the tin was $1,082,088, an average price of 56.81c. per pound. Working costs were $341,778; duty, freight and smelting charges were $188,544; a total of $530,322. The dredge operating profit amounted to $551,766. The cost of mining was 13.41c. per cubic yard, a reduction of 2.15c. from the cost of the previous year. With cheaper power and increased capacity, it is expected that the mining cost will be still further reduced. Two new dredges are in the course of construction.

Statement of Income, Year 1925

	Production	Working Costs	Operating Gain
Dawson hydraulics	$366,662.90	$248,098.71	$118,564.19
Murray dredge	116,461.30	87,390.49	29,070.81
Malay dredges	1,082,088.28	530,322.00	551,766.28
Miscellaneous operations	61,532.06	1,937.45	59,594.61
Total operations	$1,626,744.54	$867,748.65	$758,995.89
Non-operating income			106,329.65
Total income			$865,325.54
Less			
Royalties		$78,211.35	
General expense and examinations		85,411.42	
Interest charges	$350,296.51		
Less adjustment	179,259.69	171,036.82	
Depletion		100,564.28	
Depreciation		275,532.48	
Loss on sale of Trinity River dredge		370,133.82	
Loss due to abandonment of Trinity River lease		244,866.56	1,325,738.73
Net deficit for the year 1925			$460,413.19

Ahumada Lead

The Ahumada Lead Co., operating in northern Chihuahua, for the quarter ended March 31, 1926, reports a net income of $363,837 after depreciation, taxes, and a charge of $122,648 profit on lead sold prior to March 31, 1925, but undelivered at that date. This compares with $422,646 in the first quarter of 1925.

The company produced 18,604 tons of ore, for which the smelter returned 10,147,347 lb. of lead, an average of 545.4 lb. per ton. During the three months 11,646,769 lb. of lead was sold. Cash and cash assets on hand March 31 totaled $921,094.

Amparo Mines Co.

The Amparo Mines Co., operating near Etzatlan, Jalisco, Mexico, during 1925 mined and milled 87,167 metric tons of ore, against 122,833 tons for 1924, 150,629 tons for 1923, and 157,465 tons for 1922.

Operating costs were $7.66 per metric ton, compared with $6.65 for 1924.

There have been no new discoveries of ore in the mine and operations are not expected to continue long.

On the other hand, the two adjoining properties, Mazata and Piedra Bola, are now producing and giving satisfactory results. The Amparo company controls the first of these and has an operating agreement with the other and the mill will continue to operate on ore from these mines.

Production and Mill Report

Gold and silver bars		$818,420.44
Concentrates		85,748.53
		$902,168.97
Operating costs as per cost sheet		667,851.70
Gross profit		$234,517.27
Various credits		36,897.80
		$271,215.07
Depreciation	$33,411.58	
Damages and losses	4,698.53	
Sundries	3,755.09	
		41,865.20
Net profit		$229,349.87

Hecla Profit $581,571 for Quarter

The statement for the first quarter of 1926 of the Hecla Mining Co., operating in the Cœur d'Alene district in Idaho, follows:

Gross income		$1,161,147.59
Operating expenses	$431,978.71	
Taxes accrued	87,000.00	
Depreciation (estimated)	60,597.33	
Total expenses		597,576.04
Net profit		$581,571.55
Tons mined		86,190
Pounds lead produced		14,796,023
Average lead price		$8.52
Ounces silver produced		414,389
Average silver price		$0.66

Granby Earns $429,598 in Quarter

The Granby Consolidated Mining, Smelting & Power Co., Ltd., for the quarter ended March 31, 1926, reports net income of $429,598 after expenses and interests, but before depreciation and depletion, comparing with $195,960 in first quarter of 1925.

Income account for quarter ended March 31, 1926 compares as follows:

	1926	1925	1924
Gross	$1,314,724	$1,292,734	$1,172,942
Expenses	876,594	1,040,148	835,730
Operating income	$447,130	$252,586	$337,212
Other income	53,027	15,254	54,386
Total income	$500,157	$267,840	$391,598
Interest	70,559	71,880	71,435
Net income before depreciation and depletion	$429,598	$195,960	$320,163

Net production of copper for the quarter was 9,390,890 lb., an average of 3,130,296 lb. per month, compared with a monthly average of 3,027,607 lb. for preceding quarter.

Cost of production of marketable copper during the quarter was 9.24c. a pound. These costs include usual credit for precious metals and miscellaneous earnings, but exclude fixed charges and credits for income from outside investments.

Allenby production for the first quarter aggregated 3,822,957 lb. of copper from 144,514 tons of ore milled during the period. Profits from operations at Allenby were $55,749 for the quarter. These quantities and profits are not included in Granby statistics given in the statement.

Mining Stocks—Week Ended June 12, 1926

Stock	Exch.	High	Low	Last	Last	Div.
COPPER						
Anaconda	New York	46½	45⅛	46	Ap.17, My.24	0.75
Arcadian Consol.	Boston	*70	*75	*70		
Ariz. Com'L	Boston	10	9½	10	Jy.21, Jy. 31 SA	0.50
Calaveras	N. Y. Curb	1⅛	1⅛	1⅛		
Calumet & Arizona	New York	60½	60	60⅛	Jn. 4, Jn. 21 Q	1.50
Calumet & Hecla	Boston	13⅞	13½	13⅞	Jn. 1, Jn. 15 Q	0.50
Cerro de Pasco	New York	65½	63⅞	65	Ap. 15, My. 1, Q	1.00
Chile Copper	New York	32⅞	32½	32⅞	Jn.2,Jn.28, Q	0.62½
Chino	New York	22⅞	21½	22	Sept., 1920	0.37½
Con. Coppermines	N. Y. Curb	3⅛	2⅞	3		
Copper Range	Boston	14¼	14	14⅛	May, 1925	1.00
Crystal Copper	Boston Curb	*35	*30	*35		
East Butte	Boston	3	2⅛	2⅛	Dec., 1919	0.50
First National	Boston Curb	*17	*16	*17	Feb., 1919	0.15
Franklin	Boston			*40		
Granby Consol.	New York	19½	19	19⅜	May, 1919	1.25
Greene-Cananea	New York	11⅞	11	11⅛	Nov., 1920	0.50
Hancock	Boston	*50	*50	*50		
Howe Sound	New York	34⅞	34	34⅞	Ap.1, Ap.15	0.75
Inspiration Consl.	New York	23⅜	22⅞	23⅛	Jn.7, Jy.6, Q	0.50
Iron Cap	Boston Curb	3⅜	3½	3⅜	Jn. 1, Jn. 15	0.50
Isle Royale	Boston	10⅞	9½	10⅛	Jn. 1, Jn. 15	0.50
Jerome Verde Dev.	N. Y. Curb			*67		
Kennecott	New York	53½	52⅜	53½	Jn. 4, July 1 Q	1.00
Lake Copper	Boston	1	*80	1	June, 1925	0.50
Magma Copper	New York	37⅜	36⅞	37⅛	Mh.31,Ap.15,Q	0.75
Mason Valley	N. Y. Curb	1⅜	1⅜	1⅜		
Mass Consolidated	Boston			*25	Nov., 1917	1.00
Miami Copper	New York	13	12	12⅝	My.1, My.15 Q	0.25
Mohawk	Boston	32½	31⅞	32	My.1, Je.1 Q	1.00
Mother Lode Coa.	New York	6½	6	6	Jn. 15, Jn. 30	0.37½
Nevada Consol.	New York	13⅜	12⅜	13⅜	Jn. 15, Jn. 30 Q	0.25
New Cornelia	Boston	20½	19⅞	20⅛	My.7, M.24 Q	0.40
North Butte	Boston	2⅜	2¼	2⅜	Oct., 1918	0.25
Ohio Copper	N. Y. Curb	*62	*60	*61	No. 14, De. 2	0.05
Old Dominion	Boston	15⅛	14⅛	15	Dec., 1918	1.00
Phelps Dodge	Open Mar.	†125	†120		Jun.22, July2 Q	1.50
Quincy	Boston	18	16⅞	18⅛	Mar., 1920	1.00
Ray Consolidated	New York			12⅜	Ap.20, Ap.30	0.25
Ray Hercules	N. Y. Curb			11⅞		
St. Mary's Min. Ld.	Boston	28	27	27	Ap.17, My.18	2.00
Seneca Copper	New York	5⅜	5⅛	5⅛		
Shannon	Boston	*58	*35	*55	Nov., 1917	0.25
Superior & Boston	Boston			*60		
Tenn. C. & C.	New York	11⅝	11⅛	11⅝	My. 29Ju.15,Q	0.25
United Verde Ex.	N. Y. Curb	28	27½	27¼	Ap.6, My.1,	0.75
Utah Copper	New York			100	Jn.15,Jn.31,Q	1.25
Utah Metal & T.	Boston	1⅜	1⅛	1⅜	Dec., 1917	0.30
Victoria	Boston	*41	*41	*41		
Walker Mining	Salt Lake			*46		
NICKEL-COPPER						
Internat. Nickel	New York	36¾	35⅛	†36½	Jn.17,Jn.30, Q	0.50
Internat. Nickel, pfd.	New York			104	Ap.15, My.1, Q	1.50
LEAD						
Gladstone M. M. Co.	Spokane	*35½	*34½	*35½	Jn. 10, July10	0.1½
National Lead	New York	157⅞	152	157½	Jn. 11, Jn. 30 Q	2.00
National Lead pfd.	New York	117	117	117	My.21, Je.15 Q	1.75
St. Joseph Lead	New York	41	39½	40	Je.10, Je. 21 QX	0.75
ZINC						
Am. Z. L. & S.	New York	8	6½	8	May., 1920	1.00
Am. Z. L. & S, pfd.	New York	34⅜	29	34⅜	Nov., 1920	1.50
Butte C. & Z	New York	4⅞	4⅞	4⅞	De.10, De.24	0.50
Butte & Superior	New York	12	11⅛	11½	Jn.15, Jn.30 Q	0.50
Callahan Zn-Ld	New York	1⅛	1⅛	1⅛	Dec., 1920	0.50
Eagle Picher	Cincinnati	28	27¼	27¼	My. 15, Jn.1	0.40
Eagle Picher, pfd.	Cincinnati			110	Mh.31, Ap.15Q	1.50
New Jersey Zn	N. Y. Curb			208	Jn.9, Jy.10 Q	2.00
United Zinc	N. Y. Curb			*70		
Yellow Pine	Los Angeles	*25	*25	*25	De.8, De.18 Q	0.04
GOLD						
Alaska Juneau	New York	1⅜	1⅜	1⅜		
Argonaut	Toronto	*23½	*22	*22		
Barry-Hollinger	Toronto	*46½	*44	*44		
Carson Hill	Boston	*30	*20	*20		
Consol. W. Dome L.	Toronto	*15	*14½	*14½		
Cresson Consol. G.	N. Y. Curb	2	2	2	Mh.31, Ap.10	0.10
Crown Reserve	Toronto	*12	*10	*10½	Jan., 1917	0.05
Dome Mines	New York	14	13⅜	13⅜	Jn.30,July 20,Q	0.50
Golden Center	N. Y. Curb	1⅜	1⅜	1⅜		
Golden Cycle	Colo. Springs	†1.49	†1.48		No.30,Dec.10 Q	0.03
Hollinger Consol.	Toronto	19.90	−9.25	19.90	Ju. 1, Jn. 17	0.08
Homestake Mining	New York	53¼	53	53	Jn.19, Jn. 25 M	0.50
Kirkland Lake	Toronto	1.16	1.11	1.14		
Lake Shore	Toronto	11.50	11.25	11.40	Ju.1, Jn. 15 Q	0.10
McIntyre-Porcupine	New York	25	25	25	My.1, Je.1	0.25
Newray	Toronto	*32½	*32½	*32½		
Night Hawk Pen.	Toronto	*7	*6½	*6½		
Noranda	N. Y. Curb	15½	15	15⅝		
Portland	Colo. Springs	*48	*48	*48	Apr.6, Apr.15	0.02
Rand Mines	New York	33	33	33	Fe.16, Fe.26	1.52
Teck-Hughes	Toronto	3.64	3.50	3.61	Ja. 15, Fe. 1	0.05
Tom Reed	Los Angeles	*65	*62½	*65	Ma.10Ma.20	0.02
Tough-Oakes	Toronto	*39	*37	*38		
United Eastern	N. Y. Curb			*35	July, 1924	0.05
Vipond Cons.	Toronto	1.65	1.62	1.64		
Wright-Hargreaves	Toronto	8.42	8.40	8.40	Ju.15, Jy.1 QX	0.07½
Yukon-Alaska Trust	N. Y. Curb			21½		
GOLD AND SILVER						
Carnegie Metals	Boston	16½	16½	16½		
Con. Cortez	N. Y. Curb	*7	*6	*6		
Con. Virginia	San Francisco	*8½	*6½	*8		
Continental Mines	N. Y. Curb			*45		
Dolores Esperanza	N. Y. Curb			*42	July, 1923	0.05
Tremier Gold	N. Y. Curb	2⅜	2⅞	2⅜	Jn.18, Jy.3 Q	0.08
Tonopah Belmont	N. Y. Curb	3	2⅞	3	Se.15, Oc.1	0.05
Ponopah Extension	N. Y. Curb	*45	*45	*45	Apr. 1925	0.05
Tonopah Mining	N. Y. Curb	5⅜	5⅛	5⅜	Ap.7, Ap.21 Q	0.07½
Unity Gold	N. Y. Curb			*20		
West End Consol.	N. Y. Curb	*20	*20	*20	Mar., 1923	0.05
Yukon Gold	N. Y. Curb	*30	*30	*30	June, 1918	0.02

Stock	Exch.	High	Low	Last	Last	Div.
SILVER						
Alvarado	N. Y. Curb			1	Oct., 1920	0.50
Beaver Consol.	Toronto	*75	*72	*75	May. 1920	0.03
Castle-Trethewey	Toronto	1.38	1.35	1.36		
Coniagas	Toronto	3.40	3.40	3.40	May, 1924	0.12½
Keeley	Toronto	1.48	1.46	1.47	Ma. 1,Ma.15 X	0.12
Kerr Lake	N. Y. Curb			1	Ap.1, Ap.15	0.12½
La Rose	Toronto	*11	*9⅜	*10	Apr., 1922	0.10½
Lorrain Trout Lake	Toronto			*85	Jy. 2, Jy. 15	0.05
McKinley-Dar.-Sav.	Toronto	*16½	*15½	*15	Oct., 1920	0.03
Mining Corp. Can.	Toronto	3.58	3.50	3.50	Jy.1, Jy.15	0.12½
Nipissing	N. Y. Curb	5⅛	5⅛	5⅛	Mh.31, Ap.20,Q	0.15
Temiskaming	Toronto	*15	*15	*15	Jan., 1920	0.40
SILVER-LEAD						
Ahumada	New York	8⅛	7⅞	8⅛	Jn.18,Jy.5, Q X	0.25
Alta Merger	Salt Lake	†*5½	†*2½			
Bingham Mines	Boston	35	29	35	Jn.19,Jn.30 Q	1.00
Cardiff M. & M.	Salt Lake	*51	*50	*51	De.16, No.18	0.10
Chief Consol.	Salt Lake	2.90	2.90	2.90	Ap.1, My.1 Q	0.10
Emma Silver	Salt Lake	†*50	†*25			
Erupcion	Boston Curb	1⅜	1 7/16	1 7/16	Jn.18, Jy.5,QX	0.10
Federal M. & S.	New York	68½	62½	68		
Federal M. & S., pfd.	New York	73	72½	73	My.25, Ju.15 Q	1.75
Hawthorne Mines	N. Y. Curb	*20	*18	*18		
Hecla Mining	N. Y. Curb	16¾	16½	16¾	My.15, Je.15 Q	0.50
Iron King Mining	Salt Lake			*20		
Keystone Mining	Salt Lake	*31	*30	*30	Au.12, Au.26	0.07½
Lucky Jim	Spokane	*17⅜	*15⅛	*17⅜		
Mammoth Mining	Salt Lake			2.77½	Mar.24,Apr. 1	0.10
Marsh Mines	Spokane	*2½	*2⅜	*2½	Se.15, Oc.1	0.15
Park Utah	Salt Lake	6.25	6.00	6.25	Jn.15, Jy.1 Q	0.15
Prince Cons	Salt Lake	1.75	1.25	1.75		
Silver King Coal	Salt Lake	8.50	8.20	8.50	June 2, July 1, Q	0.25
Silversmith	Spokane	*48	*48	*48	Apr. 1, Apr.10	0.02
Tamarack-Custer	Spokane	*33½	*31	*32	Sept., 1924	0.25
Tintic Standard	Salt Lake	13.12½	13.00	13.00	Jn.16, Jn.26,	0.40
Utah-Apex	Boston	8⅛	8⅛	8⅛	Apr. 9, Apr. 15	0.25
Western Utah Copper	N. Y. Curb			*8		
IRON						
Bethlehem Steel	New York	41⅛	40⅛	41	July, 1924	1.25
Colorado Fuel & Iron	New York	41⅛	39⅜	40	May, 1921	0.75
Gt. North'n Iron Ore	New York	20	19⅛	20	De. 4, De. 28,	0.75
Inland Steel	New York	40⅛	38⅛	39⅜	My.10, Je.1 Q	0.75
Mesabi Iron	N. Y. Curb	1⅜	1⅜	1⅜		
Replogle Steel	New York	10	9⅛	9⅛		
Republic I. & S.	New York	51⅜	49	51⅜	May, 1921	1.50
Republic I. & S. pfd.	New York	95½	95	95½	Jn.15, July1, Q	1.75
Sloss-Sheffield S. & I.	New York	129¼	124½	128⅜	Jn.10, Jn.21 Q	1.50
Sloss-Shef. S.&I. pfd.	New York			104⅜	Jn.21, July.1, Q	1.75
U. S. Steel	New York	137	125⅜	126⅜	Jn.2, Jn.29 Q	1.75
U. S. Steel pfd	New York	130⅛	128	130	My.4, My.29,Q	1.75
Virginia I. C. & C.	New York	50	50	50	Jan., 1924	1.50
Virginia I.C.&C.pfd	New York			73	Jn.1, July 2,	2.50
ALUMINUM						
Alum.Co.of Amer.	N. Y. Curb	75	70	74½		
Alum. Co. of Amer pf.	N. Y. Curb	100	99¼	100	June 15, July 1, Q	0.01½
VANADIUM						
Vanadium Corp.	New York	35⅜	34⅛	35	My.1, My.15, Q	0.75
ASBESTOS						
Asbestos Corp., New	Montreal	24	22	23¾	De.31, Ja.15 Q	1.50
Asbestos Corp., pfd.	Montreal	79¾	77½	78½	De.31, Ja.15, Q	1.50
SULPHUR						
Freeport Texas	New York	34½	32½	33⅜	Nov., 1919	1.00
Texas Gulf	New York	140⅜	138⅛	139¾	Jn.1, Jn. 15, Q	2.50
DIAMONDS						
De Beers Consol.	New York	31½	31¼	31½	Ja.26, Fe.2	0.23
PLATINUM						
So. Am. Gold & P.	N. Y. Curb	4⅛	4⅛	4⅜		
MINING, SMELTING, REFINING AND GENERAL						
Amer. Metal	New York	51	50	51	My.20, Je. 1, Q	1.00
Amer. Metal pfd.	New York			113½	My.20, Je. 1 Q	1.75
Amer. Sm. & Ref.	New York	125½	121	125	Ap.16, My.1, Q	1.75
Amer. Sm.&Ref.pfd.	New York	118	117¼	117⅝	My.7, Je.1, Q	1.75
Consol. M. & S.	N. Y. Curb			208	De.31, Ja.15	0.75
Federated Metals	N. Y. Curb	14	13	13		
Newmont Mining	N. Y. Curb	55⅜	51⅝	55½	Mar.31,Apr.15,	0.60
Southwest Metals	N. Y. Curb			2		
U. S. Sm. R. & M.	New York	39¾	38⅛	39½	Ap.8, Ap.15, Q	0.87½
U. S. Sm. R.&M.pfd.	New York	48¾	48⅜	48½	Ap.8, Ap.15, Q	0.87½

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Henry Sachs, Colorado Springs, Colo.

PRICE WEEK ENDED JUNE 1, 1926

Name	High	Low	Last	Last Divd. Date	Amount
Aramayo Mines (25 frs.)	81/10½	81/3	81/3	May. 1926	5 p.c.†
British Platinum (£1)	6/—	4/9	6/—	Feb. 1925	2½ p.c.
Burma Corpn. (10 rupees)	15/4½	15/1½	15/3	Feb. 1926	6 annas*
Bwana M'Kubwa (5s)	8/1½	7/—	8/—		
Camp Bird (£1)	5/6	4/10½	5/1½		
El Oro (£1)	6/3	6/—	6/3	Nov. 1924	2½ p.c.*
Esperanza (10s)	1/1½	1/1½	1/1½		
Frontino & Bolivia (£1)	8/9	8/9	8/9	Jan. 1926	1½ p.c.
Mexican Corpn. (£1)	17/—	16/3	17/—		
Mexico Mines of El Oro (£1)	30/—	28/9	30/—	Dec. 1925	12½ p.c.*
Oroville Dredging (£1)	3/10½	3/3	3/9	Dec. 1923	3½ p.c.
Ouro Preto (£1)	2/6	2/6	2/6	May 1925	2½ p.c.
Rhodesian Congo Border	107/6	104/4½	105/—		
St. John del Rey (£1)	8/9	8/—	8/9	June 1925	6½ p.c.
San Francisco Mines (10s)	28/4½	27/4½	28/3	Jan. 1926	22½ p.c.
Santa Gertrudis (£1)	21/4½	20/9	21/8	July 1920	5 p.c.
Selukwe (2s. 6d.)	11/7½	10/10½	11/6	April 1917	6¾ p.c.
S. Amer. Copper (2s.)	4/7½	4/4½	4/6	Nov. 1917	75 p.c.
Tanganyika (£1)	40/3	36/10½	38/1½	Sept. 1925	5 p.c.
Tomboy (£1)	3/9	3/3	3/6	Jan. 1926	5 p.c.
Union Miniere du Haut-Katanga (Brussels)	6.650	6.600	6.600	July 1925	150 frs.‡

* Free of British income tax. † Swiss frs. ‡ Belgian frs.